Journal of Environmental and Public Health

Geochemical and Geothermal Systems in Environmental Evaluations

Lead Guest Editor: Sivakumar P
Guest Editors: N. Selvaraju and Veeramuthu Ashokkumar

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Tongzhang Zheng, USA

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https://doi.org/10.1155/2023/9765490

Retraction

Retracted: Mechanical Characteristics and Permeability Characteristics of Dry-Hot Rock Mass

Journal of Environmental and Public Health

Received 5 December 2023; Accepted 5 December 2023; Published 6 December 2023

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We wish to credit our Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

References

[1] D. Yang, C. Lu, W. Wen, H. Cheng, and D. Cadasse, "Mechanical Characteristics and Permeability Characteristics of Dry-Hot Rock Mass," *Journal of Environmental and Public Health*, vol. 2023, Article ID 5298404, 7 pages, 2023.

Hindawi
Journal of Environmental and Public Health
Volume 2023, Article ID 9848042, 1 page
https://doi.org/10.1155/2023/9848042

Retraction

Retracted: High-Temperature-Resistant, Clean, and Environmental-Friendly Fracturing Fluid System and Performance Evaluation of Tight Sandstone

Journal of Environmental and Public Health

Received 10 October 2023; Accepted 10 October 2023; Published 11 October 2023

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Hindawi
Journal of Environmental and Public Health
Volume 2023, Article ID 9873901, 1 page
https://doi.org/10.1155/2023/9873901

Retraction

Retracted: Perception of the Impact of Artificial Intelligence in the Decision-Making Processes of Public Healthcare Professionals

Journal of Environmental and Public Health

Received 26 September 2023; Accepted 26 September 2023; Published 27 September 2023

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References

[1] Y. Saleh Ibrahim, W. Khalid Al-Azzawi, A. A. Hamad Mohamad, A. Nouri Hassan, and Z. Meraf, "Perception of the Impact of Artificial Intelligence in the Decision-Making Processes of Public Healthcare Professionals," *Journal of Environmental and Public Health*, vol. 2022, Article ID 8028275, 8 pages, 2022.

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Journal of Environmental and Public Health
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https://doi.org/10.1155/2023/9786069

Retraction

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Journal of Environmental and Public Health

Received 26 September 2023; Accepted 26 September 2023; Published 27 September 2023

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References

[1] L. Jiang and N. Yu, "Research on Teaching Design of Geochemistry and Biology under the Background of Ecological Environment and Information Technology," *Journal of Environmental and Public Health*, vol. 2022, Article ID 3785862, 8 pages, 2022.

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Journal of Environmental and Public Health
Volume 2023, Article ID 9763039, 1 page
https://doi.org/10.1155/2023/9763039

Retraction

Retracted: Hyperspectral Image Analysis of Colon Tissue and Deep Learning for Characterization of Health care

Journal of Environmental and Public Health

Received 26 September 2023; Accepted 26 September 2023; Published 27 September 2023

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References

[1] A. Akram Abdulrazzaq, S. Sulaiman Hamid, A. T. Al-Douri, A. A. Hamad Mohamad, D. Selvi, and A. Mohamed Ibrahim, "Hyperspectral Image Analysis of Colon Tissue and Deep Learning for Characterization of Health care," *Journal of Environmental and Public Health*, vol. 2022, Article ID 8670534, 11 pages, 2022.

Hindawi
Journal of Environmental and Public Health
Volume 2023, Article ID 9760232, 1 page
https://doi.org/10.1155/2023/9760232

Retraction

Retracted: The Practices of Solid Waste Utility and Thriving Conditions of Logistics (a Case of Tepi Town): A Study to Treat the Healthy Environment

Journal of Environmental and Public Health

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References

[1] N. Amare, O. Al-Bhadly, M. Birhan, S. Sulaiman Hamid, and A. A. H. Mohamad, "The Practices of Solid Waste Utility and Thriving Conditions of Logistics (a Case of Tepi Town): A Study to Treat the Healthy Environment," *Journal of Environmental and Public Health*, vol. 2022, Article ID 8391616, 5 pages, 2022.

Hindawi
Journal of Environmental and Public Health
Volume 2023, Article ID 9759232, 1 page
https://doi.org/10.1155/2023/9759232

Retraction

Retracted: The Status Quo of College Students' Participation in English Online Learning in the Blended Learning Environment and the Ways to Improve It

Journal of Environmental and Public Health

Received 26 September 2023; Accepted 26 September 2023; Published 27 September 2023

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In addition, our investigation has also shown that one or more of the following human-subject reporting requirements has not been met in this article: ethical approval by an Institutional Review Board (IRB) committee or equivalent, patient/participant consent to participate, and/or agreement to publish patient/participant details (where relevant).

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References

[1] W. Cai, "The Status Quo of College Students' Participation in English Online Learning in the Blended Learning Environment and the Ways to Improve It," *Journal of Environmental and Public Health*, vol. 2022, Article ID 7255034, 11 pages, 2022.

Hindawi
Journal of Environmental and Public Health
Volume 2023, Article ID 9756316, 1 page
https://doi.org/10.1155/2023/9756316

Retraction

Retracted: Public View of Public Health Emergencies Based on Artificial Intelligence Data

Journal of Environmental and Public Health

Received 26 September 2023; Accepted 26 September 2023; Published 27 September 2023

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Hindawi
Journal of Environmental and Public Health
Volume 2023, Article ID 9765490, 1 page
https://doi.org/10.1155/2023/9765490

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Journal of Environmental and Public Health

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Hindawi
Journal of Environmental and Public Health
Volume 2023, Article ID 5298404, 7 pages
https://doi.org/10.1155/2023/5298404

Research Article

Mechanical Characteristics and Permeability Characteristics of Dry-Hot Rock Mass

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Received 18 July 2022; Revised 28 July 2022; Accepted 3 August 2022; Published 7 July 2023

Academic Editor: Sivakumar Pandian

As a rock mass with shallow burial, high temperature, and large-scale development, the study of its mechanical and seepage characteristics plays an important role in the efficient development of geothermal energy. With the development of geothermal energy in China, a breakthrough has been made in the exploration of dry-hot rocks, and the realization of efficient development of dry-hot rocks has become the focus of attention. Systematic research on rock mechanics and seepage characteristics of dry-hot rocks has become a key research topic. Granite is the most typical dry-hot rock. In this paper, granite in the Qinghai area is selected as the research object, and experiments on physical characteristics, mechanical parameters, and seepage characteristics of granite are carried out to study the effects of different depths and temperatures on mechanical parameters and seepage characteristics of granite. The results show that the physical parameters of granite in Qinghai do not change obviously with the increase of depth, and granite has the characteristics of low water absorption and low porosity. At the same time, the parameters of water absorption and porosity at different depths are close, and the dispersion is small, so the rocks are very dense. The rocks have relatively high P-wave velocity and low S-wave velocity, and the elastic wave velocity changes little at different depths. With the increase of confining pressure, the strength of granite rock increases. Under different confining pressures, the rock shows brittle failure characteristics after the peak stress. According to Hoek–Brown and Mohr–Coulomb strength curves, the strength value is 173.52 MPa. After high temperature treatment, a complex fracture network is formed in the granite. With the increase of temperature, the permeability and porosity of the granite increase continuously, and 500°C is the temperature threshold. When the temperature is lower than 300°C and the stress is less than 30 MPa, the granite has negative Poisson's ratio, and the permeability and effective stress of dry-hot rocks are piecewise linear functions. The research results provide theoretical guidance for fracturing of dry-hot rocks and exploitation of geothermal energy.

1. Introduction

With the rapid development of economy, energy shortage has become an important factor hindering the development of global economy. As a new energy source, geothermal energy is clean, safe, and easy to exploit [1]. Geothermal energy development and utilization rose in 1950s. With the rapid growth of energy demand, geothermal energy exploitation entered a period of rapid development [2]. As geothermal energy storage rock mass, dry-hot rock has great potential and development prospect and has become an irreplaceable important energy source in China's sustainable development [3].

Granite, as the most important dry-hot rock, has the characteristics of shallow burial, high temperature, and exploitable utilization. At present, the research on granite mainly focuses on genesis, resource evaluation, exploration methods, etc., while the research on mechanics and seepage characteristics of dry-hot rocks is less [4, 5]. Some researchers have carried out triaxial loading and unloading experiments and microstructure analysis of granite. With the increase of confining pressure, Poisson's ratio and elastic

modulus of granite also increase [6]. The mechanical properties and anisotropy of fine-grained granite are studied. The confining pressure has an influence on the failure mode of fine-grained granite. Under the condition of low confining pressure, the fine-grained granite breaks and forms a complex fracture network [7, 8]. Some researchers have carried out triaxial compression on granite in different areas. Under low confining pressure, the granite is mainly cracked and double shear, while under high confining pressure, the granite is mainly single shear [9]. Some researchers have studied the characteristics of permeability, deformation, and anisotropy of granite with the change of confining pressure and analyzed the microstructure of samples by SEM, revealing the reasons of permeability and deformation of granite [10]. Some researchers have developed instruments to measure the physical characteristics and porosity of low-permeability rocks and have used this instrument to carry out low-permeability and porosity experiments on granite core samples [11]. Some researchers have carried out triaxial seepage experiments of granite under different axial pressures, confining pressures, and air pressures and analyzed the influence of stress and gas slippage effect on the permeability k_0 of granite [12]. It is found that k_0 is negatively exponentially related to stress difference and stress gradient at a lower pressure gradient, and the attenuation is most significant when the pressure gradient is 0~0.2 MPa. According to the nanoscale pore characteristics of granite, some researchers have analyzed the seepage characteristics of granite under different stress conditions [13–15]. The results show that the flow produced by Darcy flow is directly proportional to pressure, pressure gradient, and permeability.

As a rock mass with shallow burial, high temperature, and large-scale development, the study of its mechanical and seepage characteristics plays an important role in the efficient development of geothermal energy [16–18]. Systematic study of the mechanical and seepage characteristics of dry-hot rock mass has become a key research topic. Granite is the most typical dry-hot rock. In this paper, the granite in the Qinghai area is taken as the research object, and the physical, mechanical, and seepage characteristics of granite with different depths are studied experimentally [19–21]. The effects of different depths and temperatures on the mechanical and seepage characteristics of granite are studied, which provides theoretical guidance for the fracturing of dry-hot rock and the exploitation of geothermal energy [22].

2. Sample Preparation and Test Methods

2.1. Sample Preparation. The core is taken from the outcrop of Indosinian granite in Qinghai area, and it is medium-fine grained and porphyritic, mainly composed of Shi Ying, feldspar, and biotite. In this paper, granite cores at different drilling depths (100 m, 200 m, 300 m, 400 m, 500 m, and 600 m) are selected (Figure 1), which are mainly medium-fine porphyritic granodiorite. See Table 1 for information of core collection. After the core obtained by drilling is marked, it is kept in good condition by the sampling box, which reduces the damage caused by strong disturbance during transportation.

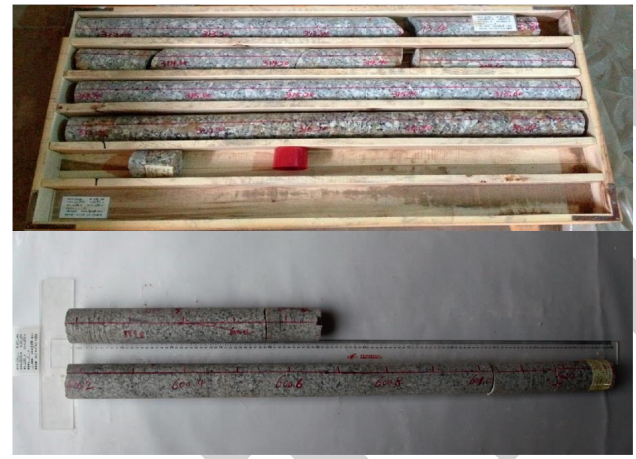

Figure 1: Granite core.

The diameter of the drilled core obtained onsite is 63 mm, and the rock samples meeting the test standards are prepared through fine processing by rock coring machine, cutting machine, and grinding machine. According to GB/T 50266-99 and SL264-2001, when rock is subjected to triaxial compression test, the specimen should be a cylinder with a diameter of 48 mm~54 mm, a height-diameter ratio of 2.0~2.5, an allowable deviation of height and diameter of ±0.3 mm, and unevenness of both ends of the specimen. In this paper, the processing size of the core is required to be $\Phi 50 \times 100$ m, as shown in Figure 2.

2.2. Test Plan and Test Method

2.2.1. Testing of Petrophysical Parameters. Before obtaining the mechanical characteristics of rock, it is necessary to count the physical parameters of rock samples. In this paper, the block density, particle density, water content, water absorption, porosity and wave velocity parameters of drill cores at different depths are tested. Four rock samples are selected for each depth, totaling 24, and the average values of the samples at different depths are counted as the physical parameters of rock testing. Measure the diameter, length, and quality of the test by using vernier caliper and electronic scale. The direct wave is used to measure the longitudinal wave velocity of the sample. The specific steps are as follows: the wave transducers are placed at the axial ends of the sample and clamped, and the transducers and the sample are coupled with vaseline. The instrument records data every 0.1 μs to calculate the longitudinal wave velocity of the sample. Table 2 shows the basic physical parameters of samples with different depths.

2.2.2. Rock Mechanics Test. Rock mechanical parameters include uniaxial and triaxial compressive strength, tensile strength, and shear strength. The domestic standard of engineering rock mass test method and the suggested method of rock mechanics test put forward by the International Society of Rock Mechanics is adopted for the experiment. Triaxial compression test was carried out on granite rock samples according to relevant specifications.

Table 1: Core collection records.

Serial number	Sample number	Sampling point		Sample length (m)	Sample name
		Huiji	Start-end (m)		
1	QH01	83 (1/3)	93.41~93.08	67	
2	QH01	157 (4/5)	201.33~201.45	12	
3	QH01	227 (5/7)	301.98~304.32	34	Medium-fine porphyritic biotite granodiorite
4	QH01	283 (1/1)	400.82~402.25	43	
5	QH01	330 (2/6)	501.89~503.55	66	
6	QH01	372 (5/6)	599.33~603.09	76	

Figure 2: Rock sample diagram.

Table 2: Basic physical parameters of samples with different depths.

Drilling depth (m)	Average diameter (mm)	Average height (mm)	Average mass (g)	Moisture content (%)	Saturated water absorption (%)	Total porosity (%)	Longitudinal wave velocity (ms^{-1})
100	50.04	100.41	467.1	0.091	0.342	0.851	3535.56
200	50.42	99.98	468.49	0.089	0.345	0.843	3447.33
300	50.58	99.91	471.97	0.092	0.341	0.847	3362.63
400	50.37	100.23	480.49	0.091	0.345	0.862	3457.84
500	50.41	100.13	482.09	0.087	0.337	0.856	3653.88
600	50.94	99.94	463.9	0.088	0.338	0.860	3460.75

The triaxial compression test of rock mass in this paper is completed by the MTS815.03 pressure test system (Figure 3). The press is produced by MTS Company of the United States, which mainly carries out conventional mechanical tests of rock, concrete, and other materials, and is equipped with a servo-controlled fully automatic triaxial compression and measurement system. The system consists of loading part, testing part, control part, and program control. The maximum vertical pressure of the system is 4600 kN, the maximum vertical deformation is 100 m, the maximum confining pressure is 140Mpa, and the overall stiffness of the test frame is 11.0×109 N/m.

The MTS rock mechanics test system is used to carry out triaxial compression test of rock, and the deformation parameters and triaxial strength parameters of rock under different confining pressures are obtained. The test process is as follows:

Figure 3: MTS rock mechanics test system.

(1) The heat-shrinkable tube is sleeved on the core, heated and shrunk by a hot air gun, and the core is fixed between the upper and lower pressure heads. The heat-shrinkable tube can fix the core well and isolate the core from direct contact with silicone oil.

(2) After the heat-shrinkable tube is heated, the core will be heated to cause radial shrinkage. To prevent the measurement error caused by heating, the heated core should stand at room temperature for more than 5 h.

(3) Install the radial strain sensor in the middle of the core, put it into the triaxial chamber, lower the confining cylinder, lock the bolt tightly, inject hydraulic oil (dimethyl silicone oil), and exhaust the gas.

(4) After the confining pressure cylinder is filled, add confining pressure to the triaxial chamber, and load it to the predetermined confining pressure value at a rate of about 5 MPa per minute, and load the confining pressure to the specified value at a rate of 2 MPa/min.

(5) Start the axial loader, adopt axial strain control, and carry out axial loading at the rate of 0.02%/min. When the sample is suddenly destroyed, the system will automatically stop, and there is a good back zone of stress-strain relationship. When the load is close to zero, the test will be stopped manually.

After the completion of the test, the damaged samples were treated with Nano Vox EL-3502E micro-CT observation heat treatment to analyze the spatial distribution of cracks. The experimental steps are as follows: the sample is fixed on the gripper, and the crosscut gray image of the sample is obtained by scanning it in CT scanning room. The fracture distribution of the core was obtained by 3D reconstruction.

2.2.3. Rock Seepage Test. Granite has the characteristics of small porosity and low permeability, and the permeability directly affects the heat extraction of granite. In this paper, the pulse attenuation test method is used to test the permeability change law of granite. In this experiment, HPPD-100 pulse attenuation permeameter produced by GCTS Company of the United States was used, and the effective permeability range was 10 nd–1 md. Before the pulse penetration test, first fully saturate the pore fluid in the sample. Main test steps are as follows:

(1) Fill the system pipeline and container with fluid and apply a small pressure from the pore pressure booster

(2) Open a part of the valves, let the pore liquid flow out, open the feedback channel of the displacement sensor of the pore pressure booster, push the liquid with the booster, and let the liquid flow out from the upper pressure head

(3) Adopting a pore pressure supercharger to push the liquid, flowing out of the lower pressure head, installing the saturated sample, and sealing with a heat-shrinkable tube

(4) Close the pressure chamber, apply a small contact load and confining pressure, and achieve the preloading state; use the pore pressure booster to apply appropriate pressure and wait for a few minutes, and then close the valve

(5) Clear the differential pressure sensor, slowly discharge the lower pressure until the read data reaches the preset pressure difference, and check the readings of the two pressure sensors until the balance point is reached

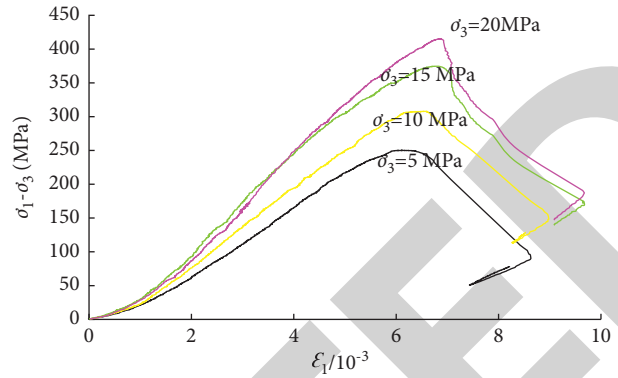

Figure 4: Stress-strain relationship during loading failure of specimens under different confining pressures.

During the test, the pore pressure should be kept at 1 MPa and the differential pressure should be 250 KPa. By pressurizing with water purification, the deviating stress of confining pressure is always kept at about 1 MPa, and the permeability is measured once every 3 MPa increase and once every 10 MPa when the effective stress is greater than 20 MPa.

3. Experimental Results and Analysis

3.1. Physical Experiment Results of the Sample. Physical parameters of rock samples were obtained by physical tests. As can be seen from Table 1, the water content of granite rock samples is 0.08%–0.09%, the saturated water absorption is 0.33%–0.35%, the total porosity is 0.84%–0.87%, and the P-wave velocity is above 3300 m/s. The granodiorite is characterized by high density, low water content, low water absorption, and low porosity. The rock is very dense, with good mineral cementation and uniform grain development.

3.2. Mechanical Test Results of Samples. Triaxial compression tests of granite samples under 5 MPa, 10 MPa, 15 MPa, and 20 MPa are carried out in this test. Figure 4 shows the stress-strain relationship in the process of loading failure of the samples under different confining pressures. It can be seen from Figure 4 that, during the loading process of the sample, the first stage is compaction, but this stage is not obvious because of the dense granite. After the sample enters the elastic stage, the stress and strain are linearly positively correlated until the sample reaches the peak strength. After the peak strength of the sample, there is no ductility behavior, but it falls linearly directly and finally reaches the residual strength. At the same time, with the increase of confining pressure, the yield stage becomes obvious, and the ductility stage gradually becomes obvious after the peak strength. The damaged rock and rock mass still have high residual strength, which can be loaded again.

Triaxial compression test results (Table 3) of samples with a depth of about 100 m under different confining

Table 3: Triaxial compression test results of samples under different confining pressures.

Core number	Confining pressure (MPa)	Modulus of elasticity (GPa)	Poisson's ratio	Triaxial compressive strength (MPa)
1	5	51.07	0.233	233.13
2	10	51.27	0.24	302.16
3	15	51.25	0.30	378.68
4	20	52.07	0.29	418.29

pressures are selected. From the table, it can be seen that the peak strength of the rock increases with the increase of confining pressure, and the axial deformation of the rock reaches 0.63 mm when it reaches the peak strength. With the increase of confining pressure, the residual strength also increases, and the strength is still above 80 MPa.

According to the experimental results, the deformation and strength of the sample change obviously with the increase of confining pressure. Because the contact degree between mineral grains is randomly distributed, the deformation effect of each mineral component is different, which leads to the change of the internal stress field. Under the action of stress, the microcracks of the sample close, and the strength is determined by the friction of grains. Therefore, the friction between grains in the shear plane is high, so the residual strength is high.

The denaturation characteristics of rock are mainly represented by Young's modulus and peak strain. Young's modulus mainly includes elastic modulus and deformation modulus. The elastic modulus refers to the slope of the approximate straight line part of the axial stress-axial strain curve of the sample, and the deformation modulus refers to the slope of the line connecting the sample with the origin at 50% axial stress. Figure 5 shows the variation diagram of Young's modulus of rock samples with confining pressure. From the fitting curve in the figure, it can be seen that, with the increase of confining pressure, Young's modulus of rock samples increases and the sensitivity of deformation modulus and elastic modulus of rock samples to confining pressure is basically the same. This is mainly due to the strong connection force and close contact between granite mineral particles, which causes little deformation in the initial compression stage and is not obvious in the compaction stage.

With the increase of confining pressure, the triaxial compressive strength of the specimen increases. Under different confining pressures, granite samples show brittle failure characteristics after peak stress. According to the triaxial compression strength data of the samples, the Hoek–Brown and Mohr–Coulomb strength curves and strength parameter values of granite samples are calculated (Figure 6). It can be seen from the figure that the strength of granite is 173.52 MPa, the internal friction angle φ is 56.79, and the cohesion C is 29.27 MPa.

3.3. Experimental Results of Sample Seepage. According to the sample seepage experiment, the permeability of the sample under different effective stress is counted, as shown in Table 4. It can be seen from Table 4 that the permeability of the sample decreases gradually with the increase of

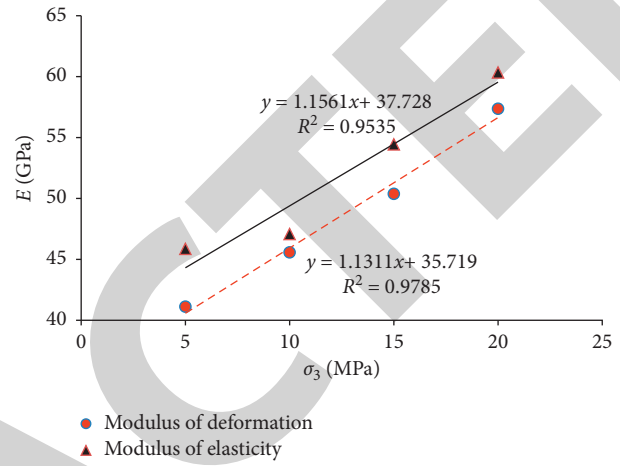

Figure 5: Changes of Young's modulus-confining pressure of the sample.

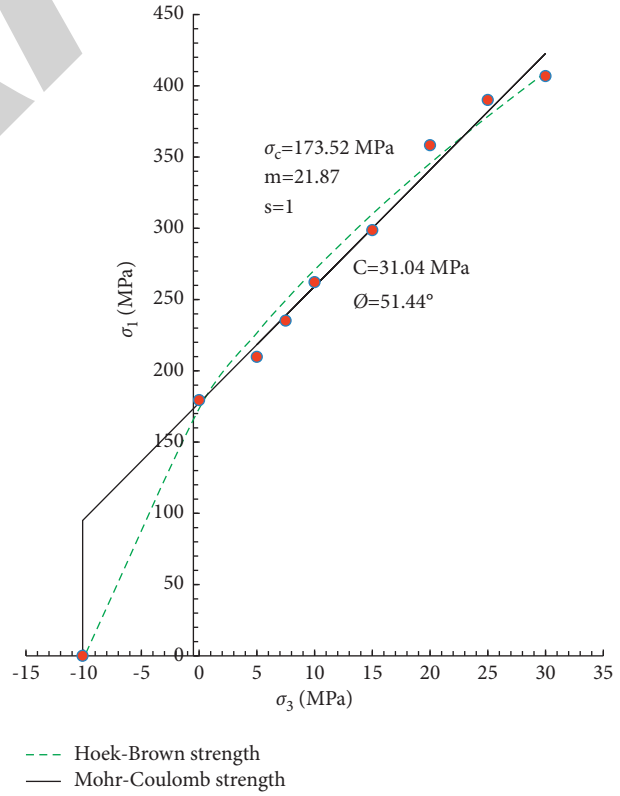

Figure 6: Strength curve of granodiorite (490m~510 m) in borehole TH01.

effective stress: when the effective stress is less than 21 MPa, the permeability of the sample decreases rapidly with the increase of effective stress. When the effective stress exceeds

Table 4: Changes of permeability of specimen with effective stress.

Effective stress (MPa)	1	3	6	9	12	15	18	21	30	40	50	60
Sample permeability (md)	0.90	0.89	0.75	0.63	0.46	0.44	0.43	0.35	0.31	0.26	0.21	0.18

21 MPa, with the increase of stress, the permeability of the sample still decreases, but the decreasing range obviously decreases. At the same time, it is found that there is a piecewise linear function between the permeability and effective stress of granite, which is mainly due to the negative Poisson's ratio of granite. When the confining pressure and effective stress of granite increase, the negative Poisson's ratio of granite leads to the increase of its radial shrinkage. When compressed to a certain extent, the negative Poisson's ratio of dry-hot rock is suppressed, and the decrease of permeability decreases. When the confining pressure is 0 MPa, the negative Poisson's ratio of the sample is the most obvious. With the increase of confining pressure, the radial shrinkage of the sample gradually decreases. When the confining pressure exceeds 30 MPa, the negative Poisson's ratio phenomenon gradually disappears.

According to the CT scanning image, the internal structure of granite is very dense, and there are no obvious holes or cracks. However, after high-temperature heating, a large number of cracks are produced in the rock and connected with each other, forming a complex crack network. When the granite is treated at 500°C, the cracks will extend horizontally and vertically, forming a grid-like crack network. With the increase of temperature, the porosity and permeability of the sample increase obviously. When the temperature reaches 500°C, the increase is the largest, and the porosity increases from 3.6% to 7.0%. The permeability increases from 0.08 md to 0.82 md, which increases by an order of magnitude. Therefore, it can be considered that, about 500°C is the threshold temperature for the change of granite physical properties. When the hot dry rock is lower than this threshold temperature, the heat is affected by adsorbed water and interlayer water. When the temperature is higher than the threshold, a large number of new pores are generated in the rock mass and connected with each other, and the permeability increases rapidly.

According to the statistics of the accumulated heat production at different injection velocities, it can be seen that the heat production gradually increases with the increase of the flow velocity. When the flow velocity exceeds 42 kg/s, the total heat production reaches the peak value of 5.8×1013 J. After that, the total heat production begins to decrease with the increase of the flow velocity, which is mainly affected by the negative Poisson's ratio. During geothermal exploitation, by injecting cold water into the rock reservoir for heat exchange, the temperature of dry hot rock around the production well gradually decreases. The injected water pressure causes the pore pressure to increase and the effective stress of rock to decrease gradually. When the temperature drop of the rock mass exceeds a certain value, the phenomenon of negative Poisson's ratio begins to appear in the dry hot rock, which greatly affects the permeability of the fracture and reduces the heat recovery rate. Therefore, in the actual geothermal development, the injection speed of cold water needs to be controlled reasonably, and the greater the injection speed, the worse the effect will actually be. Increasing the injection velocity can obviously improve the heat recovery rate, but it will shorten the life of the whole heat recovery system and may also lead to the decline of the final heat recovery. In the actual production, the water injection speed should be controlled reasonably to ensure the heat production efficiency and avoid the negative Poisson's ratio effect of dry-hot rock as much as possible.

4. Conclusion

Dry-hot rock is a kind of rock mass with shallow burial, high temperature, and large-scale development. With the large-scale development of geothermal energy in China, the exploration of dry-hot rocks has become a key concern, and systematic research on rock mechanics and seepage characteristics of dry-hot rocks has become a key research topic. Granite is the most typical dry-hot rock. Taking granite in Qinghai as the research object, this paper studies the mechanical parameters and seepage characteristics of granite with different depths and temperatures and obtains the mechanical properties and seepage characteristics of dry-hot rock, which provides theoretical guidance for the fracturing of dry-hot rock and exploitation of geothermal energy. The main research results are as follows:

(1) Through physical test, the water content of granite samples is 0.08% ~ 0.09%, the saturated water absorption is 0.33% ~ 0.35%, the total porosity is 0.84% ~ 0.87%, and the longitudinal wave velocities are all above 3,300 m/s. Triaxial compression tests were carried out on granite samples under different confining pressures. With the increase of confining pressures, the peak strength of granite samples increased and was above 200 MPa. At the same time, when the rock reached the peak strength, the axial deformation reached 0.63 mm, and the residual strength also increased and was above 80 MPa. With the increase of confining pressure, Young's modulus of the sample increases. The experimental statistics show that the strength of granite is 173.52 MPa, the internal friction angle φ is 56.79, and the cohesion C is 29.27 MPa.

(2) The internal structure of granite is very dense, with no obvious holes or cracks. After high temperature heating, a large number of cracks are produced in the rock and connected with each other, forming a complex crack network. Through seepage experiment, the permeability of the sample decreases gradually with the increase of effective stress. At the same time, when the effective stress is less than

Hindawi
Journal of Environmental and Public Health
Volume 2023, Article ID 9819810, 1 page
https://doi.org/10.1155/2023/9819810

Retraction

Retracted: Impaction of Rehabilitations and Strengthening Programs before and after Anterior Cruciate Ligament Reconstruction in Return to the Fitness Level

Journal of Environmental and Public Health

Received 27 June 2023; Accepted 27 June 2023; Published 28 June 2023

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We wish to credit our own Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

References

[1] A. A. Alzahrani, "Impaction of Rehabilitations and Strengthening Programs before and after Anterior Cruciate Ligament Reconstruction in Return to the Fitness Level," *Journal of Environmental and Public Health*, vol. 2022, Article ID 7906341, 7 pages, 2022.

Hindawi
Journal of Environmental and Public Health
Volume 2023, Article ID 9792879, 1 page
https://doi.org/10.1155/2023/9792879

Retraction

Retracted: Treatment of Pharma Effluent using Anaerobic Packed Bed Reactor

Journal of Environmental and Public Health

Received 27 June 2023; Accepted 27 June 2023; Published 28 June 2023

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References

[1] D. S. Vijayan, A. Mohan, C. Nivetha et al., "Treatment of Pharma Effluent using Anaerobic Packed Bed Reactor," *Journal of Environmental and Public Health*, vol. 2022, Article ID 4657628, 6 pages, 2022.

Hindawi
Journal of Environmental and Public Health
Volume 2023, Article ID 9790238, 1 page
https://doi.org/10.1155/2023/9790238

Retraction

Retracted: A PCA-DEA-Based Model for Assessing the Sustainability of Marine Economy

Journal of Environmental and Public Health

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References

[1] H. Yao, J. Huang, and J. Li, "A PCA-DEA-Based Model for Assessing the Sustainability of Marine Economy," *Journal of Environmental and Public Health*, vol. 2022, Article ID 2412588, 7 pages, 2022.

Hindawi
Journal of Environmental and Public Health
Volume 2023, Article ID 9761904, 1 page
https://doi.org/10.1155/2023/9761904

Retraction

Retracted: The Construct and Interpretation of Chelated Coordination Polymers and Their Use in Nanomaterials Research

Journal of Environmental and Public Health

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References

[1] K. Abbas Omran, "The Construct and Interpretation of Chelated Coordination Polymers and Their Use in Nanomaterials Research," *Journal of Environmental and Public Health*, vol. 2022, Article ID 3937375, 13 pages, 2022.

Hindawi
Journal of Environmental and Public Health
Volume 2023, Article ID 9753570, 1 page
https://doi.org/10.1155/2023/9753570

Retraction

Retracted: Logic and Three Wheel Drive Analysis from New Urbanization to URI and Rural Revitalization under the Background of Ecological Environment Sustainability

Journal of Environmental and Public Health

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References

[1] H. Guo, "Logic and Three Wheel Drive Analysis from New Urbanization to URI and Rural Revitalization under the Background of Ecological Environment Sustainability," *Journal of Environmental and Public Health*, vol. 2022, Article ID 3085446, 7 pages, 2022.

Hindawi
Journal of Environmental and Public Health
Volume 2023, Article ID 9898740, 1 page
https://doi.org/10.1155/2023/9898740

Retraction

Retracted: Evaluation of Knowledge, Attitude, and Practice of Health Practitioners towards Fertility Preservation in Cancer Patients in an Environmental Region of Saudi Arabia

Journal of Environmental and Public Health

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References

[1] R. Ahmad Sindi, M. Salem Bagabas, L. Mamdoh Al-Manabre, R. Zahi Al-Sofee, R. Yousef Rednah, and S. Meshal Al- Jahdali, "Evaluation of Knowledge, Attitude, and Practice of Health Practitioners towards Fertility Preservation in Cancer Patients in an Environmental Region of Saudi Arabia," *Journal of Environmental and Public Health*, vol. 2022, Article ID 6404837, 11 pages, 2022.

Hindawi
Journal of Environmental and Public Health
Volume 2023, Article ID 9898704, 1 page
https://doi.org/10.1155/2023/9898704

Retraction

Retracted: Cognitive Analysis of Pragmatic Functions of Discourse Markers in Spoken English in the Context of Computational Intelligence

Journal of Environmental and Public Health

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References

[1] L. Huang and Y. Zhu, "Cognitive Analysis of Pragmatic Functions of Discourse Markers in Spoken English in the Context of Computational Intelligence," *Journal of Environmental and Public Health*, vol. 2022, Article ID 9883324, 6 pages, 2022.

Hindawi
Journal of Environmental and Public Health
Volume 2023, Article ID 9858063, 1 page
https://doi.org/10.1155/2023/9858063

Retraction

Retracted: Role of Radiology and Laparoscopy in Childhood Peptic Ulcer Perforation

Journal of Environmental and Public Health

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References

[1] M. Demir, M. Akın, N. Yücel, A. Unal, D. Gürel, and E. Yaşa, "Role of Radiology and Laparoscopy in Childhood Peptic Ulcer Perforation," *Journal of Environmental and Public Health*, vol. 2022, Article ID 1211499, 8 pages, 2022.

Hindawi
Journal of Environmental and Public Health
Volume 2023, Article ID 9857139, 1 page
https://doi.org/10.1155/2023/9857139

Retraction

Retracted: Measuring the Awareness of Chronic Kidney Disease (CKD) with Environmental Evaluation among Adult Diabetic Patients in Hail Region, Saudi Arabia

Journal of Environmental and Public Health

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References

[1] A. Nahlah Fahad, A. Ahmed Alkhateeb, A. Rabah Alsharari, A. Naif Alharbi, and A. Abdullaziz Hamed, "Measuring the Awareness of Chronic Kidney Disease (CKD) with Environmental Evaluation among Adult Diabetic Patients in Hail Region, Saudi Arabia," *Journal of Environmental and Public Health*, vol. 2022, Article ID 4505345, 6 pages, 2022.

Hindawi
Journal of Environmental and Public Health
Volume 2023, Article ID 9847034, 1 page
https://doi.org/10.1155/2023/9847034

Retraction

Retracted: Relationship between Economic Growth and Energy Consumption from the Perspective of Sustainable Development

Journal of Environmental and Public Health

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References

[1] L. Dai, R. Jia, and X. Wang, "Relationship between Economic Growth and Energy Consumption from the Perspective of Sustainable Development," *Journal of Environmental and Public Health*, vol. 2022, Article ID 6884273, 10 pages, 2022.

Hindawi
Journal of Environmental and Public Health
Volume 2023, Article ID 9829732, 1 page
https://doi.org/10.1155/2023/9829732

Retraction

Retracted: Research on Sino Japanese Comparative Literature from the Perspective of Sustainable Ecological Environment

Journal of Environmental and Public Health

Received 27 June 2023; Accepted 27 June 2023; Published 28 June 2023

This article has been retracted by Hindawi following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of one or more of the following indicators of systematic manipulation of the publication process:

(1) Discrepancies in scope

(2) Discrepancies in the description of the research reported

(3) Discrepancies between the availability of data and the research described

(4) Inappropriate citations

(5) Incoherent, meaningless and/or irrelevant content included in the article

(6) Peer-review manipulation

The presence of these indicators undermines our confidence in the integrity of the article's content and we cannot, therefore, vouch for its reliability. Please note that this notice is intended solely to alert readers that the content of this article is unreliable. We have not investigated whether the authors were aware of or involved in the systematic manipulation of the publication process.

Wiley and Hindawi regrets that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our own Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

References

[1] Q. Fang, "Research on Sino Japanese Comparative Literature from the Perspective of Sustainable Ecological Environment," *Journal of Environmental and Public Health*, vol. 2022, Article ID 5396135, 6 pages, 2022.

Hindawi
Journal of Environmental and Public Health
Volume 2023, Article ID 9828903, 1 page
https://doi.org/10.1155/2023/9828903

Retraction

Retracted: Research on Mental Health Status of College Chinese Learners from the Perspective of Sustainable Development of Ecological Environment

Journal of Environmental and Public Health

Received 27 June 2023; Accepted 27 June 2023; Published 28 June 2023

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References

[1] Y. Liu and X. Jin, "Research on Mental Health Status of College Chinese Learners from the Perspective of Sustainable Development of Ecological Environment," *Journal of Environmental and Public Health*, vol. 2022, Article ID 6594651, 6 pages, 2022.

Hindawi
Journal of Environmental and Public Health
Volume 2023, Article ID 9867104, 1 page
https://doi.org/10.1155/2023/9867104

Retraction

Retracted: Securitization Concept and Its Application to Environmental Problems in the Kurdistan Region: Prospects and Obstacles

Journal of Environmental and Public Health

Received 14 February 2023; Accepted 14 February 2023; Published 9 March 2023

Journal of Environmental and Public Health has retracted the article titled "Securitization Concept and Its Application to Environmental Problems in the Kurdistan Region: Prospects and Obstacles" [1] due to concerns that the peer review process has been compromised.

Following an investigation conducted by the Hindawi Research Integrity team [2], significant concerns were identified with the peer reviewers assigned to this article; the investigation has concluded that the peer review process was compromised. We therefore can no longer trust the peer review process, and the article is being retracted with the agreement of the Chief Editor.

Nusret Sinan Evcan agrees to the retraction; Salam Abdulqadir Abdulrahman was unresponsive.

References

[1] S. A. Abdulrahman and N. S. Evcan, "Securitization Concept and Its Application to Environmental Problems in the Kurdistan Region: Prospects and Obstacles," *Journal of Environmental and Public Health*, vol. 2022, Article ID 8122568, 9 pages, 2022.

[2] L. Ferguson, "Advancing Research Integrity Collaboratively and with Vigour," 2022, https://www.hindawi.com/post/advancing-research-integrity-collaboratively-and-vigour/.

Hindawi
Journal of Environmental and Public Health
Volume 2023, Article ID 9861737, 1 page
https://doi.org/10.1155/2023/9861737

Retraction

Retracted: Assessment of the Knowledge Level of First Aid among Medical Students in Work Environment

Journal of Environmental and Public Health

Received 27 January 2023; Accepted 27 January 2023; Published 7 February 2023

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The authors do not agree to the retraction.

References

[1] Asma Alanazi, Saad Algethami, Mohammed Alnafisah, Saoud Alhussayen, Fares Almutairi, Sultan Almureef, Maram Albalawi, and Farida Habib, "Assessment of the Knowledge Level of First Aid among Medical Students in Work Environment," *Journal of Environmental and Public Health*, vol. 2022, Article ID 8381819, 5 pages, 2022.

[2] L. Ferguson, "Advancing Research Integrity Collaboratively and with Vigour," 2022, https://www.hindawi.com/post/advancing-research-integrity-collaboratively-and-vigour/.

Hindawi
Journal of Environmental and Public Health
Volume 2023, Article ID 9853235, 1 page
https://doi.org/10.1155/2023/9853235

Retraction

Retracted: Analysis of China's Population Flow between Urban and Rural Areas and the Reform of Public Health Old-Age Insurance System under the Background of Sustainable Ecological Environment

Journal of Environmental and Public Health

Received 15 November 2022; Accepted 15 November 2022; Published 5 February 2023

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References

[1] H. Guo and Q. Luo, "Analysis of China's Population Flow between Urban and Rural Areas and the Reform of Public Health Old-Age Insurance System under the Background of Sustainable Ecological Environment," *Journal of Environmental and Public Health*, vol. 2022, Article ID 9752913, 2022.

[2] L. Ferguson, "Advancing Research Integrity Collaboratively and with Vigour," 2022, https://www.hindawi.com/post/advancing-research-integrity-collaboratively-and-vigour/.

Hindawi
Journal of Environmental and Public Health
Volume 2023, Article ID 9849648, 1 page
https://doi.org/10.1155/2023/9849648

Retraction

Retracted: Economic Growth Effect of Public Health Investment and Its Impact on Living Environment

Journal of Environmental and Public Health

Received 15 November 2022; Accepted 15 November 2022; Published 30 January 2023

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References

[1] J. Meng, "Economic Growth Effect of Public Health Investment and Its Impact on Living Environment," *Journal of Environmental and Public Health*, vol. 2022, Article ID 2192255, 7 pages, 2022.

[2] L. Ferguson, "Advancing Research Integrity Collaboratively and with Vigour," 2022, https://www.hindawi.com/post/advancing-research-integrity-collaboratively-and-vigour/.

Hindawi
Journal of Environmental and Public Health
Volume 2023, Article ID 9840913, 1 page
https://doi.org/10.1155/2023/9840913

Retraction

Retracted: Study on the Impact of Chinese Comedy International Communication on the Health of Older People under Cultural Ecological Environment

Journal of Environmental and Public Health

Received 15 November 2022; Accepted 15 November 2022; Published 30 January 2023

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References

[1] Y. Zhang, W. Wang, and J. Wei, "Study on the Impact of Chinese Comedy International Communication on the Health of Older People under Cultural Ecological Environment," *Journal of Environmental and Public Health*, vol. 2022, Article ID 4003853, 7 pages, 2022.

[2] L. Ferguson, "Advancing Research Integrity Collaboratively and with Vigour," 2022, https://www.hindawi.com/post/advancing-research-integrity-collaboratively-and-vigour/.

Hindawi
Journal of Environmental and Public Health
Volume 2023, Article ID 9871694, 1 page
https://doi.org/10.1155/2023/9871694

Retraction

Retracted: Research on Recurrence Plot Feature Quantization Method Based on Image Texture Analysis

Journal of Environmental and Public Health

Received 15 November 2022; Accepted 15 November 2022; Published 29 January 2023

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References

[1] Y. Li and Z. Li, "Research on Recurrence Plot Feature Quantization Method Based on Image Texture Analysis," *Journal of Environmental and Public Health*, vol. 2022, Article ID 2495024, 12 pages, 2022.

[2] L. Ferguson, "Advancing Research Integrity Collaboratively and with Vigour," 2022, https://www.hindawi.com/post/advancing-research-integrity-collaboratively-and-vigour/.

Hindawi
Journal of Environmental and Public Health
Volume 2023, Article ID 9759232, 1 page
https://doi.org/10.1155/2023/9759232

Retraction

Retracted: The Status Quo of College Students' Participation in English Online Learning in the Blended Learning Environment and the Ways to Improve It

Journal of Environmental and Public Health

Received 26 September 2023; Accepted 26 September 2023; Published 27 September 2023

This article has been retracted by Hindawi following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of one or more of the following indicators of systematic manipulation of the publication process:

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In addition, our investigation has also shown that one or more of the following human-subject reporting requirements has not been met in this article: ethical approval by an Institutional Review Board (IRB) committee or equivalent, patient/participant consent to participate, and/or agreement to publish patient/participant details (where relevant).

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The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

References

[1] W. Cai, "The Status Quo of College Students' Participation in English Online Learning in the Blended Learning Environment and the Ways to Improve It," *Journal of Environmental and Public Health*, vol. 2022, Article ID 7255034, 11 pages, 2022.

Hindawi
Journal of Environmental and Public Health
Volume 2022, Article ID 7255034, 11 pages
https://doi.org/10.1155/2022/7255034

Research Article

The Status Quo of College Students' Participation in English Online Learning in the Blended Learning Environment and the Ways to Improve It

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Received 5 July 2022; Revised 19 July 2022; Accepted 20 July 2022; Published 12 August 2022

Academic Editor: Sivakumar Pandian

In college English teaching, online resources can meet students' self-study needs and show them a variety of English knowledge. Teachers should reasonably design teaching according to the characteristics of disciplines, and give students sufficient participation to conduct online self-study and online training. Therefore, online learning can make full use of students' spare time. In this paper, the current situation of college students' participation in online English learning and the ways to improve it are studied under the blended learning environment. The research shows that more than 88% of learners can finish online learning assignments on time. When the number of experiments reaches 60, 42.97% of them can finish online learning assignments on time, 29.51% of them can partially finish online learning assignments on time, and 21.94% of them cannot. In the process of online learning, autonomy and participation are high, and few of them are in a passive state, so they follow up online learning in time. The richness of college students' English online learning content under the blended learning environment provides a foundation, and college English teachers can optimize the learning content according to their lack of practical knowledge, which greatly improves college students' participation in online English learning.

1. Introduction

In the innovative development of college students' English teaching, teachers gradually pay attention to the application of online resources. With the help of information technology, we can improve the teaching atmosphere and make the English classroom full of vitality. In order to strengthen the English level of high school students and make information technology play a positive role in the English classroom, the hybrid teaching method should be used to guide students to carry out the in-class and after-class learning in an orderly manner, so as to improve the autonomy of learning participation, make teaching more scientific, and help students accumulate more English knowledge [1]. However, affected by the quality of online learning platform curriculum resources and students' participation in online courses, there is also great uncertainty in the new model of English online learning. Relevant scholars have found that the registration rate of online English learning is high, but the course completion rate is low, and that there are a lack of high-quality curriculum resources and the weakening of users' continuous participation in learning [2]. In University English teaching, online resources can meet students' self-study needs and show students a variety of English knowledge. Teachers should reasonably design teaching in combination with the characteristics of the subject, and give students sufficient participation in online self-study and online training. Therefore, online learning can make full use of students' spare time. At the same time, the practical knowledge of college students is practical, situational, personal, integrated, and reflective. The accumulation of practical knowledge of traditional college English teachers must be completed through teachers' practice and summary [3] and reasonably control the online and offline learning participation progress. Whether online or offline, students need to be given timely learning

feedback. Carrying out some online tests based on online teaching platforms or other small programs is an important means to feedback students' learning effects. Through this feedback, we can make teaching activities more targeted, not only let students learn clearly, but also let teachers teach clearly. Of course, if we take the results of these small tests as an important basis for process evaluation, these test activities will also have the function of learning motivation. This mode can enrich students' learning content and training means, improve the efficiency of self-study after class, and promote learners' learning from shallow to deep to deep learning, which can not only improve English learning ability, but also have a positive impact on the learning of other disciplines.

In order to improve students' comprehensive quality and cultivate college students' participation in English online learning, we must first improve teachers' comprehensive quality, including professional quality. This paper analyzes the current situation of college students' participation in English online learning in a mixed learning environment and constructs a factor model for the continuous use of the college students' English online learning platform [4, 5]. By exploring the correlation between these influencing factors and college students' continuous use of online education platform, this paper puts forward corresponding improvement strategies for the University English online learning platform to adapt to the changes of college students' learning needs. Blended learning is a new learning mode that combines the advantages of various learning methods under the current educational informatization background. It mainly relies on traditional offline classroom learning and emerging online learning on network platforms. It can not only play the leading role of teachers' guidance, inspiration, and supervision in traditional classrooms, but also give students full learning autonomy. Blended learning, a combination of e-learning and traditional learning, has been widely spread and has become a hot topic in University English teaching reform. More and more universities gradually take blended learning as the basis of English learning, among which there are some stereotypes [6]. The actual implementation should be consistent, with blended learning as the core. However, due to poor equipment and related but defective facilities, policies and online learning cannot interact. Obviously, these have led to the failure of University English blended learning.

As a new learning mode, blended learning is more convenient and efficient, and brings students a sense of gain and satisfaction than other learning methods. At present, with more and more front-line teachers actively trying to carry out mixed teaching reform, the personalized learning needs of students in the mixed learning environment have been better met, and the students' autonomous participation in learning has also been further enhanced [7]. At the same time, teaching design should take learning as the center and students as the main information of the process, rather than following the continuous mode of students as passive recipients of stimuli from the outside [8]. Among many decisive factors, a successful methodology always serves the teaching goal. Specifically, how to design and conceive the correct learning program is really important. Therefore, the participation of college students in English online or distance education in blended learning means that students are actually far away from teachers and need a delivery method. The teacher-student interaction is determined by the design of technology and learning environment [9, 10]. The occurrence of spatial learning will have a considerable impact on the learning results. Online education has been studied for decades, and effective online teaching is the result of carefully designed and planned teaching. In addition, through the enrichment of college students' English online learning content in the hybrid learning environment, University English teachers can optimize the learning content according to their lack of practical knowledge, which greatly improves the participation of college students in English online learning.

For this paper, the following innovations are proposed:

(1) A model of English online learning participation is proposed. Upload the teaching content to the "group file"; after class, the "homework" function is used to publish homework. Students can submit pictures, documents, and videos in various forms of homework. For common problems, the "micro class" function is used to explain them intensively, with good results. In order to avoid the tedium caused by teachers' single teaching in the teaching process, interactive content is added to the English online learning curriculum design. First of all, guide students to associate the real life that happens to them and around them with classroom learning, improve their divergent thinking ability, and enhance their learning initiative and enthusiasm.

(2) This paper studies the application of blended learning in English online learning. Blended English teaching should be integrated into different links of English teaching. In the preview stage, teachers should formulate study plans to guide students to effectively self-study so that information technology can play a role and preview more efficiently. With the help of the advanced information technology, students can easily obtain extracurricular learning resources and listen to the pronunciation of vocabulary repeatedly, but they are prone to lack of direction due to too many resources.

The overall structure of this paper consists of five parts:

The first chapter introduces the background and significance of college students' English online learning and then introduces the main work of this paper. The second chapter mainly introduces the research status of English online learning and the research methods of English online learning proposed in this paper. The third chapter analyzes the research methods and discusses the participation in English online learning and the application of blended learning in English online learning. In Chapter 4, simulation experiments are carried out and the experimental results are analyzed. The fifth chapter is a summary of the full text.

2. Related Work

2.1. Research Status of Online English Learning. As there is an increase in the difficulty and the amount of knowledge, the review efficiency is particularly important. After the implementation of blended teaching, students can play a better role in autonomy, learn the content of micro-courses repeatedly, and have more and more vocabulary to use in dialogue. Therefore, it is necessary to continuously promote the integration of online and offline, and encourage students to improve their self-awareness. The after-class review and classroom teaching complement each other. Through self-questioning and self-reflection, the review objectives can be clearly defined, and the English level can be improved.

Gao et al. proposed that the stronger the compatibility of online education platform, the more reasonable the layout design of online education platform, the clearer the video images, and the better the audio quality, the more the college students who are willing to continue to use English online education platform for learning [11]. Kong proposed that the online education platform promoted by institution of higher learning will make full use of high-tech elements such as cloud technology and big data artificial intelligence to innovate online education mode and reshape learners' behavior. Particularly, the appearance of mobile terminal devices such as mobile phones and tablet computers has created sufficient conditions for online English learning in institution of higher learning. Therefore, online learning is supported and favored by many students [12]. Hu indicated that teachers should also integrate online and offline learning situations when making comments, and objectively evaluate students' learning attitudes and learning results so that students attach equal importance to online learning, and actively acquire learning resources to improve their learning autonomy [13]. Chen proposed that high-quality English teaching courses are the core of online learning platform service supply in institution of higher learning. If an online learning platform wants to run for a long time and maintain high popularity, it is essential for professional teachers to create high-quality and high-level English courses, so as to attract more learners and stimulate their willingness to continue online learning [14]. Truong and Wang showed there is a positive correlation between college students' feelings about the quality of English language teaching (ELT) content provided by an online platform and their willingness to continue using online platforms to learn English, and it is significant at the level of 0.01. Pearson's correlation coefficient is 0.745, which belongs to a strong correlation [15]. Liu et al. put forward that teachers should guide students to make self-evaluation, and find out the shortcomings of online English learning in combination with the teaching objectives of college students, so as to formulate a reasonable review plan and carry out an orderly review with the help of classroom notes and micro-course resources in the review stage. Many students cannot grasp the key points in the review, and they are used to reviewing from scratch according to the learning order, which leads to low review efficiency and weak grasp of important and difficult points [16]. Zhang showed that adding more real-time interactive means, such as online tutoring and online answering, can improve the interactivity of online English learning websites and systems. At the same time, various online activities should be provided for students to participate in, such as interactive games, competitions, and communities. Through timely feedback and real-time participation, students' learning initiative can be stimulated [17]. Chunlin et al. emphasized that the willingness to use continuously is the loyalty of college students' English learning users to the online education platform. Whether college students use online education platforms continuously or recommend each other actively can reflect the stickiness of the platform to users and the degree of college students' willingness to use continuously [18]. Chun meant to improve the intelligence of online English learning websites and systems and to strengthen the teaching assistance. In the process of developing websites and systems, we should give full consideration to how to give full play to teachers' guiding role and actively guide learners so that they can form a correct learning attitude and learning methods and establish a sound personality [19]. Liu et al. showed that college students who propose online English learning find that the more the students around them are also participating in online learning or the more the teachers and friends recommend them to use the online ELT platform, the more willing they are to continue to use the online ELT platform for learning [20].

2.2. The Research Method of English Online Learning Proposed in This Paper. Traditional classroom English teaching can no longer meet the increasing requirements of English learning, and the online English learning system provides a large number of constantly updated resources, breaks through the limitations of region and time, and provides students and teachers with an in-class or out-of-class online learning platform. In order to improve the effect of University English teachers' practical knowledge construction in online learning, it is necessary to effectively control the goal of college students' English online learning in the mixed learning environment in order to effectively control the participation in online learning. The generation of teachers' practical knowledge "emphasizes the overall perception, understanding, grasp, and processing of teaching situations by teachers in teaching activities." Therefore, there are two important conditions for the generation of teachers' practical knowledge. First, there are problems in specific teaching situations. Second, there is reconstruction through reflection in action until new beliefs are formed. Teachers' practical knowledge is reflected in the process of problem-solving, and its formation environment is also inseparable from the specific education and teaching situation. Teachers, as professional practitioners, have a unique way of thinking, action, and teaching. Only when the education problem needs to be solved urgently, this kind of ability knowledge can be brought into play and developed. Reflection in action is the

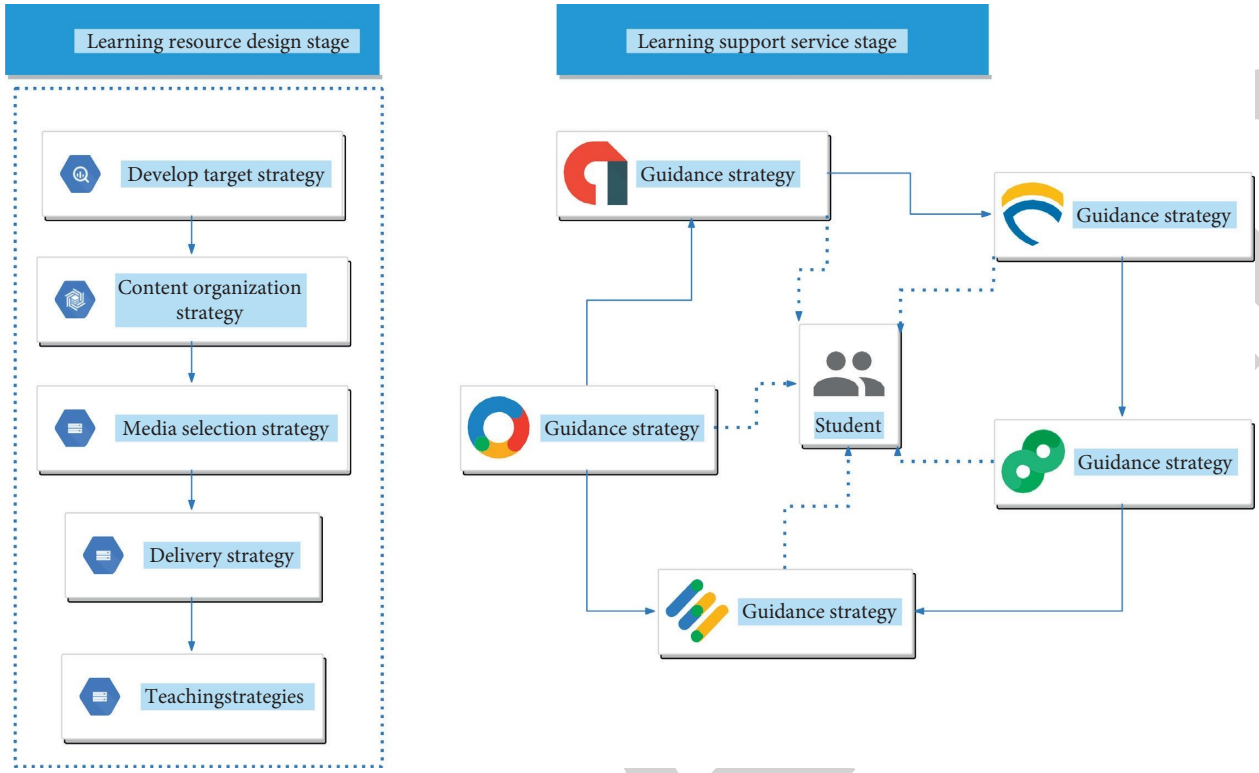

Figure 1: English online learning participation model.

embodiment of the essential characteristics of this practical knowledge. Compared with the traditional offline classroom teaching, teachers have encountered unprecedented challenges. Some teachers have fallen far behind the pace of the times because they do not pay attention to these learning platforms and do not go to the library to borrow learning materials. It is necessary to build a hybrid learning oral English learning platform to ensure the development of online teaching. There are many network platforms. Choosing the appropriate teaching platform can effectively integrate resources and focus the attention of teachers and students on learning itself. University English teachers need to choose and use the functions and contents provided by the online learning platform in the process of online learning, not only to give full play to the value of the online learning environment, but also to curb the disadvantages of the online learning environment. Blended learning gives students with learning difficulties time to prepare before class, which is conducive to overcoming their fear of difficulties and learning difficulties; and gives students with good foundation and high requirements for oral English learning more difficult and diverse course choices to meet their requirements for continuous improvement. Therefore, if teachers do not learn and improve, and still adhere to the old and backward knowledge and teaching methods, teaching on the connection will become a problem, not to mention the teaching effect. Therefore, applying blended learning to college students' English online learning participation is the trend of future learning. Teachers must keep pace with the times and study modestly in order to cultivate more excellent college students.

3. Research Method

3.1. English Online Learning Participation. The theory of learning participation believes that learning participation reflects the level of time and energy invested by students in the learning process, which is divided into cognitive input, behavioral input, and emotional input. The higher the students' participation in learning, the higher the students' learning effect and development level, and the higher the educational quality level of institution of higher learning it reflects. There are many network platforms, so choosing a suitable English teaching platform can effectively integrate resources and focus the attention of teachers and students on learning itself [21, 22]. The teaching content is uploaded to the "group file"; after class, the "homework" function is used to publish homework. Students can submit pictures, documents, videos, and various forms of homework. For common problems, the "micro class" function is used to explain them intensively, with good results. In order to avoid the tedium caused by teachers' single teaching in the teaching process, interactive content is added to the English online learning curriculum design. First of all, the teachers guide students to associate the real life that happens to them and around them with classroom learning, improve their divergent thinking ability, and enhance their learning initiative and enthusiasm. English online teaching strategy has dynamic characteristics, including orientation strategy, interaction strategy, monitoring strategy, evaluation strategy, and feedback strategy, as shown in Figure 1.

The evaluation of learning participation has become an important index for the measurement and evaluation of

educational quality in institution of higher learning, and has been paid more and more attention by educational administrators and front-line teachers in institution of higher learning. English online learning participation in the blended learning environment refers to the degree to which students participate in online courses synchronously or asynchronously using the online learning platform. It not only includes students' real-time participation in teachers' English online course teaching, but also includes students' self-study by logging on the English online learning platform after class [23]. The purpose of teaching strategy is to consciously monitor, evaluate, feedback, and adjust online teaching activities, coordinate the relationship between them as much as possible, optimize the teaching process, and achieve the teaching objectives more effectively. Therefore, the teaching strategy at this stage is not fixed, but it changes with the changes of learners, teaching context, teaching content, and other factors. It is necessary to carry out teaching activities according to the actual situation. It is particularly important to emphasize that at this stage, the single teaching link does not necessarily correspond to the teaching strategy of a teaching activity, but may also include guiding strategy, interactive strategy, and monitoring strategy [24]. On the basis of micro-courses and massive open online courses, building a flip classroom and giving students with learning difficulties preparation time before class will help them overcome their fear of difficulties and learning difficulties; giving students with good foundation and high English learning requirements more difficult and more diverse courses to choose will help them meet their requirements for continuous improvement.

In the process of online English teaching, multimedia materials such as words, pictures, videos, and audio are used, and a large number of interactive exercises, tests, thinking guidance, answering questions, and other activities are incorporated. Interactive design can play an active role in stimulating students' interest, timely feeding back the learning situation, achieving the test goal, activating students' thinking, etc., and help students better understand, absorb, and strengthen what they have learned [25]. All kinds of online English learning activities, such as autonomous learning, online questioning, online mutual evaluation, communication and discussion, homework completion, achievement sharing, and personal display, all reflect students' behavioral participation, emotional participation, and cognitive participation, which can truly and effectively reflect students' online English learning effect and personal development level [26].

3.2. The Application of Blended Learning in English Online Learning. Blended learning is a new concept put forward by the international educational technology community after in-depth consideration of networked learning based on the above understanding. A hybrid learning mode refers to a teaching method that fully integrates English online resources and offline teaching activities, gives full play to the advantages of information technology, guides students to explore independently, and effectively improves the teaching effect [27]. Blended English teaching should be implemented on the basis of mastering the discipline teaching rules. Teachers must reasonably plan English online and offline activities, guide students to learn new knowledge independently, use offline activities to test the results of self-study, and help students consolidate new knowledge and open their minds. Blended learning is a combination of online learning and face-to-face learning. It is necessary to adjust the effective mixing of learning elements such as various English learning media, learning modes, learning environment, and learning content, cultivate scholars' master learning ability, improve English learners' learning satisfaction, and optimize the combination of learning resources, so as to achieve the optimal learning effect and economic benefits. Online learning provides a learning environment with strong freedom for University English teachers, which highlights the dominant position of University English teachers in the construction of practical knowledge. However, if this freedom is not used properly, it will restrict the improvement of University English teachers' practical knowledge. In online learning, educators and learners, as well as learners and learners, are separated and do not have the binding and organizational atmosphere in the traditional classroom. Online learning can provide a platform for University English teachers to learn and communicate. University English teachers can enrich their practical knowledge according to the practice and experience of other teachers [28]. Of course, this kind of practical knowledge only includes practical knowledge that can be passed on and practical knowledge that can be understood. Some unconscious practical knowledge generated in teaching practice still needs teachers to summarize through English teaching practice.

However, blended learning should not be a simple mixture of two learning methods. Its core is to optimize the combination of learning resources according to the characteristics of the subject and make scientific and reasonable use of English resources. At present, the research on blended English learning in the foreign language community is not systematic enough. It mostly focuses on the simple combination of network and classroom English teaching mode, and has little guiding significance for teachers to carry out blended teaching. There are few studies on the integration of learning and classroom English teaching, teacher-student interaction, evaluation and feedback based on educational technology, and student-centered and comprehensive improvement of students' English professional ability. The optimization of the University English teachers' online learning environment focuses on optimizing the online learning platform composed of the Internet and computer, so as to make the online learning environment meet the needs of University English teachers' practical knowledge development; that is, it is required that the online learning environment should conform to the cognitive law of University English teachers' practical knowledge after optimization. Combining the traditional face-to-face classroom teaching method with the online autonomous learning method, turning the classroom, and learning through online and offline not only give play to the leading role of teachers,

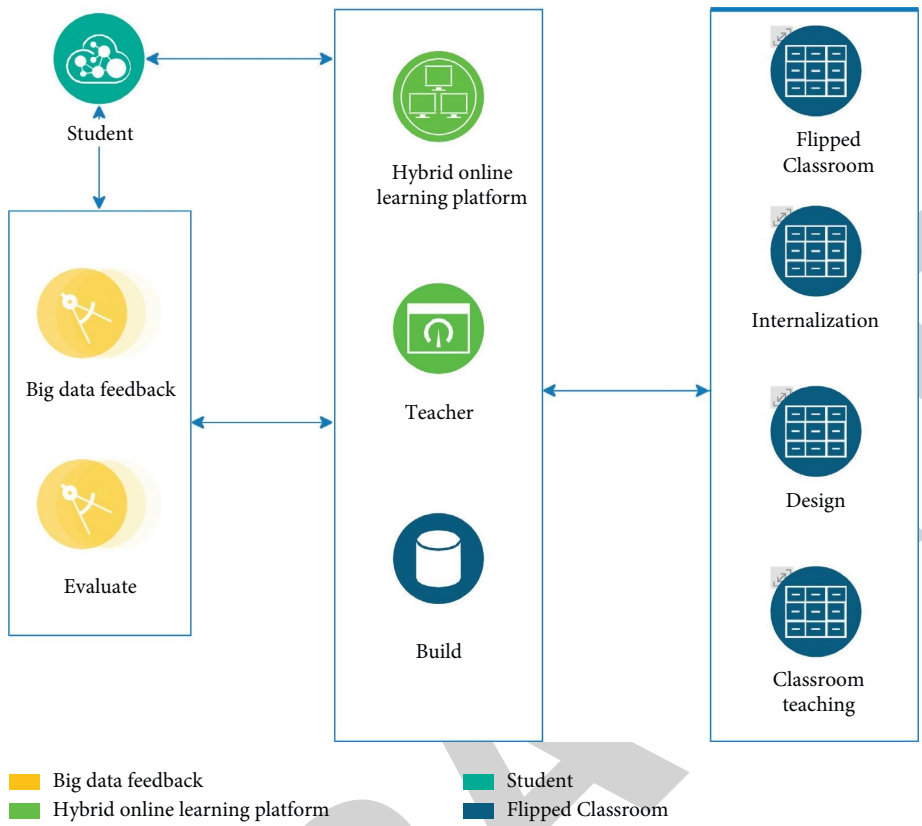

Figure 2: Student-centered blended learning space.

but also highlight the central position of learners through platform learning and cultivate learners' autonomous learning ability. The structure of the hybrid learning space is shown in Figure 2.

Blended English teaching should be integrated into different links of English teaching. In the preview stage, teachers should formulate learning plans, guide students to learn by themselves effectively, make information technology play a role, and make the preview more efficient. With the help of the advanced information technology, students can easily get extracurricular learning resources and listen to the pronunciation of vocabulary repeatedly, but it is easy to lack directionality due to too many resources. Because there are too many links in the online learning platform and college English teachers' attention is distracted, college English teachers who lack solid English professional knowledge and teaching ability will have double learning pressure brought by practical knowledge and computer operation knowledge, and the openness of learning, that is, learning content, all of which require college English teachers to make independent choices to prevent English teachers from having negative attitudes towards learning content. Self-regulated learning in the online learning environment and cooperative learning in a classroom learning environment combine and complement each other, so as to construct a brand-new learning method that can not only play the leading role of classroom learning teachers, but also embody students' knowledge construction through English learning. Rich network resources can make up for the shortage of high-quality resources in local universities.

The blended English online learning platform can provide students with all kinds of English teaching materials related to courses, such as open classes in famous universities, micro-classes, PPT in classroom teaching, supplementary materials, and links to references. The mixing of conventional classroom teaching platforms, combined with the concept of a flipped classroom, reflects the multidimensional collaborative thinking of both inside and outside the classroom, online and offline, knowledge and skills, and equal emphasis on teaching and acquisition. It is the fusion of the essence of the traditional teaching mode and the modern educational technology, and the service quality of the online platform and the influence of the students' user community. Therefore, the improvement strategies to enhance college students' willingness to use English online education platform should also be considered around these four factors.

4. Result Analysis and Discussion

This empirical study uses the reliability coefficient method to test the internal reliability of the option questionnaire. The value of the Cronbach coefficient method is used as the benchmark to measure the reliability. The higher the coefficient is, the more consistent the monitoring results are and the more reliable the data are. In specific research, the

measurement items with a reliability coefficient of more than 0.7 are usually judged to have good stability. The reliability measurement results of the questionnaire data of this sampling survey are shown in Table 1.

The Cronbach coefficient a value of each variable is greater than 0.7, indicating that the data are stable and the survey has good reliability. The teacher-student interaction is an important way of communication between teachers and students in the modern education system, and it is an important influencing factor for the smooth development of teaching, especially in the mixed learning mode. The teacher-student interaction is divided into two levels: the interaction between teachers and students and the interaction between students and students. The investigation is carried out to clarify the current situation and improve the deficiencies. This experiment mainly carries out experimental analysis from three categories: I like teachers to give feedback in time; I like to ask questions directly from teachers face-to-face; and I like to ask questions from teachers through the Internet, and then I analyze complete nonconformity, partial conformity, and complete conformity. The statistical analysis results of the teacher-student interaction are shown in Figure 3.

66% of learners prefer to ask questions through the Internet. The data show that learners prefer to communicate with teachers through the Internet under the blended learning mode, which is in line with the characteristics of the contemporary era. Only 12% of learners do not agree with the questions that teachers like to give feedback in time, which indicates that in the process of the teacher-student interaction, teachers should pay attention to timely feedback information to students, and guide them to learn efficiently and actively. Accurate feedback is the direction and motivation of learners' learning.

The frequency of each online English teaching strategy is counted in the teaching stage, as shown in Table 2, and the frequency ratio data after the frequency statistics are summarized. Through these frequency data, the use and characteristics of teachers' teaching strategies can be calculated more intuitively.

In the survey of self-cognition, most learners also have a clear level of self-cognition. Therefore, in order to improve learners' dominant position, self-evaluation and peer evaluation can also be included in the evaluation index system. Therefore, this experiment is aimed at completely inconsistent, partially consistent, and completely consistent learning. Blended learning pays more attention to learning process experience. Learning experience is the effect of learners' experience in the learning process, as shown in Figure 4.

More than 82% of learners hold a positive attitude and positive emotional experience towards the blended learning model, and it can be seen that full compliance accounts for the highest proportion in the process of blended learning, followed by partial compliance, and finally completely noncompliance. They recognize the hybrid learning method and pay attention to the learning process; from the perspective of learners' after-school learning, most learners like to reflect and summarize what they have learned, thought, and realized. In the process of English evaluation methods, we can appropriately add evaluation methods that meet the learners' self-improvement psychology, pay attention to the learners' progress in the learning process, and give feedback and evaluation in time, so as to increase learners' confidence, improve learning experience and satisfaction, and study efficiently.

Online learning participation refers to the degree to which learners participate in online learning under the hybrid learning mode, mainly from the learners' attitude towards online learning, time, number of login platforms, and resource sharing. This experiment aims at completely nonconforming, partially conforming, and fully conforming learning. The experiment is carried out to complete the online learning homework on time. The experimental results are shown in Figure 5.

More than 88% of learners can complete online learning assignments on time. As can be seen from the figure, when the number of experiments reaches 60, 42.97% of them are fully qualified to complete online learning assignments on time, 29.51% are partially qualified to complete online learning assignments on time, and 21.94% are completely unqualified to complete online learning assignments on time. In the process of online learning, autonomy and participation are high, and a few are in a passive state. It can be seen that most learners have a correct attitude towards online learning, recognize online learning methods, and follow up online learning in time. In the evaluation system, we can properly consider the learner's autonomy factors, pay attention to the learner's learning process, such as the number of forum discussions and online tests, and incorporate the corresponding evaluation methods to improve the enthusiasm of learners.

As for the question "what kind of learning method do you want to use if there are bilingual teaching courses in the future" in our interview, almost all the students who participated in the interview answered "blended learning." It can be seen that the role of blended learning in bilingual teaching has left a deep impression on students. Therefore, this experiment aims at the improvement of learners' ability. Three methods are adopted for comparison, namely, machine learning, ant colony algorithm, and hybrid learning in this paper. The experimental results are shown in Figure 6.

From the data of the three methods, it can be seen that the growth value of blended learning in this method is the highest, followed by ant colony algorithm, and finally by machine learning. Therefore, it can be concluded that blended learning can make learners gain a lot, and students think that blended learning improves their information literacy; some learners think that blended learning helps them master knowledge; others think that blended learning improves their skills and practical ability; and others think that they improve their computer ability. According to the correlation analysis between college students' willingness to use continuously and various factors, see Table 3.

College students' perception of service quality of online platform is positively correlated with their willingness to continue to use online platform to learn English, and it is significant at the level of 0.02. Pearson's correlation

Table 1: Reliability coefficients of variables in empirical research.

Variable name	Cronbach's coefficient a value	Cronbach's coefficient a value based on standardization term
Performance expectations	0.896	0.934
Service quality	0.921	0.953
Willingness to continue using	0.892	0.896
Social influence	0.982	0.911

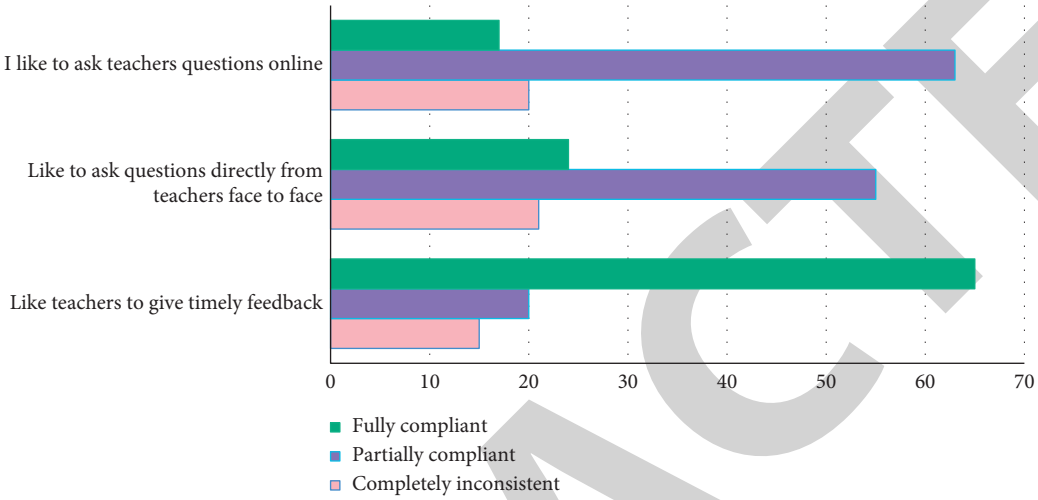

Figure 3: Statistical analysis of the interaction between teachers and students.

Table 2: Statistical table of the usage of teaching strategies in the teaching stage.

While-teaching stage					
Observation indicators	Guidance strategy	Interaction strategy	Monitoring strategy	Evaluation strategy	Feedback strategy
Lead in	82%	66.8%	6.8%	33.4%	0%
Development	26.6%	26.8%	41%	13.4%	33.4%
Presentation	86.8%	66.8%	26.8%	13.4%	21%
Total	68.7%	54.4%	52.5%	41.2%	41.2%

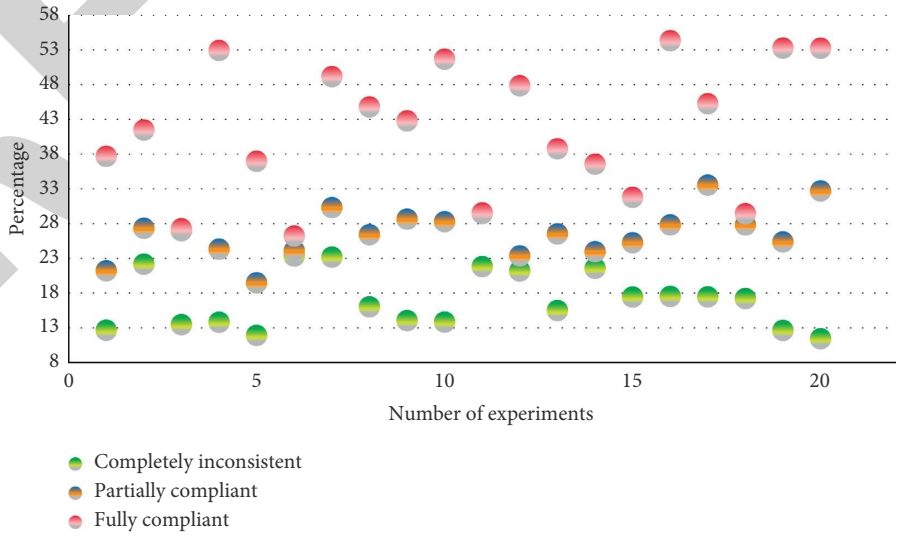

Figure 4: Blended learning pays more attention to the change of learning experience in the learning process.

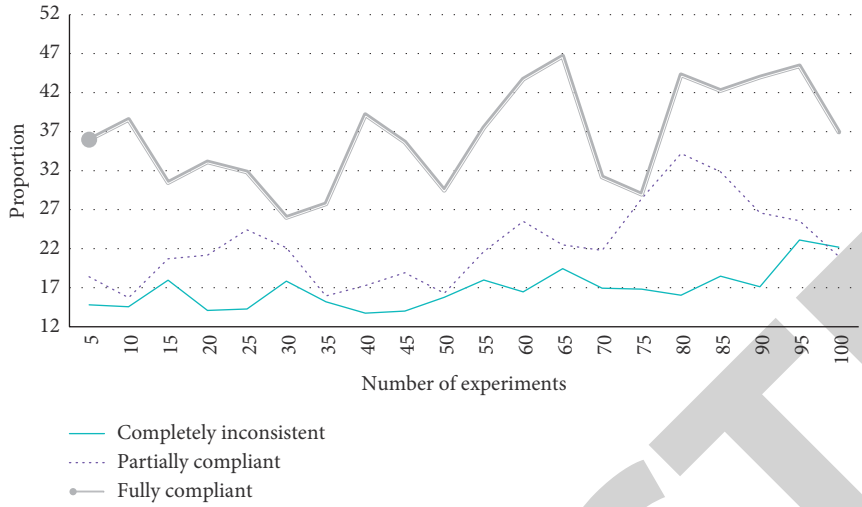

Figure 5: Change trend of being able to complete online learning assignments on time.

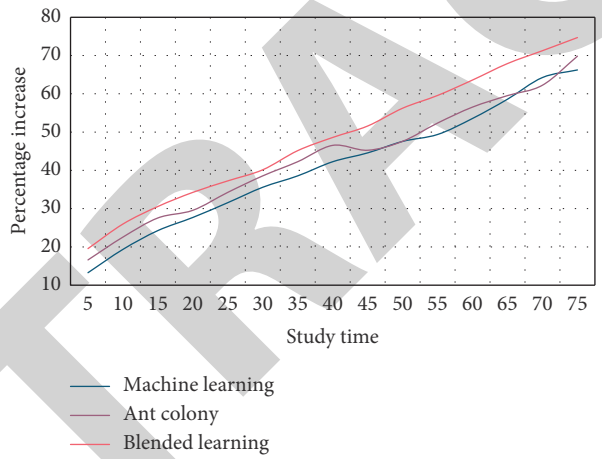

Figure 6: Curve of improvement of learners' ability under different methods.

Table 3: Correlation analysis between college students' willingness to use English online education platform and various factors.

Variable	Pearson's correlation coefficient	Significant bilateral test
Performance expectation	0.622	0.000
Quality of service	0.744	0.000
Willingness to use continuously	0.682	0.000
Community influence	0.872	0.000

coefficient is 0.622, which is a strong correlation. At the same time, there is a significant correlation between college students' willingness to use continuously and the service quality of college English online platform.

Blended learning improves English listening and reading. On the learning platform, we uploaded a large number of reading materials and video materials according to the course content, and learners unconsciously improved their English listening and reading ability while learning professional knowledge. In this experiment, aiming at English ability, the category has been greatly improved, and it has been improved to a certain extent. The experimental analysis has been carried out without any improvement, and the experimental results are shown in Figure 7.

Among the three categories, a certain increase is the highest in the three growth rates, with an average growth

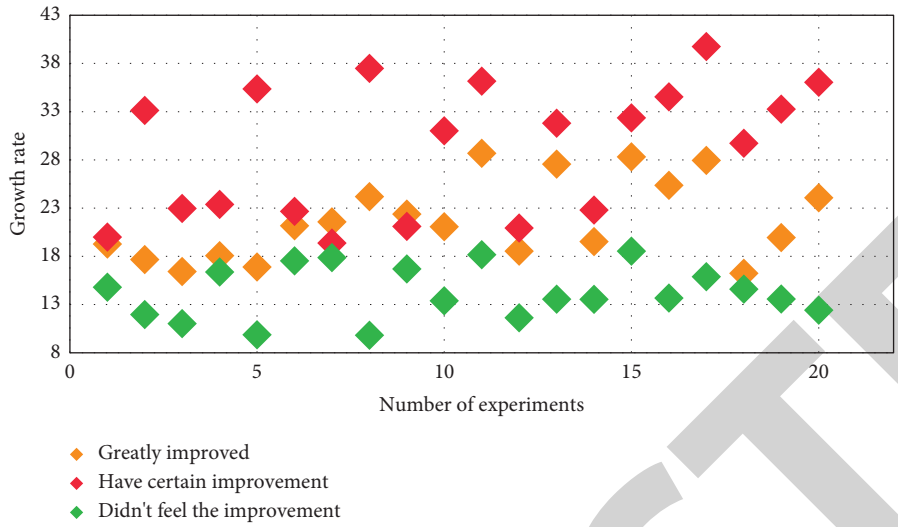

Figure 7: Improvement of English ability.

rate of 29.19%. In the second place, there was a great improvement, with an average growth rate of 21.75%. Finally, there was no improvement, with an average growth rate of 14.24%. Because we have added more cutting-edge knowledge of the discipline to the expanded resources, including the speech videos of some foreign experts and excellent research papers, students can read these expanded resources and record their learning experiences after learning the classroom knowledge. Through these exercises, students have more understanding of the cutting-edge knowledge of the discipline, thus expanding their professional vision.

5. Conclusions

University English online learning adopts the way of physical incentives to encourage learning participants to share their online learning experience with various social platforms on campus in a variety of ways, so as to achieve the purpose of effective publicity of positive word of mouth. This is also an important way to use community influence to promote college students' online learning. This paper studies the current situation and improvement path of college students' English online learning participation in a hybrid learning environment. The research shows that more than 88% of learners can complete online learning assignments on time. When the number of experiments reaches 60, 42.97% of them are fully qualified to complete online learning assignments on time, and 29.51% of them are partially qualified to complete online learning assignments on time, 21.94% did not meet the requirements of completing online learning assignments on time. In the process of online learning, autonomy and participation are high, and a few are in a passive state. It can be seen that most learners have a correct attitude towards online learning, recognize online learning methods, and follow up online learning in time. The scientific and reasonable use of hybrid learning evaluation can monitor the dynamic learning process of learners, exercise learners' autonomy, initiative, and innovation, master learning skills, improve learning quality, and develop themselves in an all-round way; at the same time, it can guide teachers to reasonably arrange teaching progress and arrangement, do a good job of teaching adjustment at any time, improve teaching level, promote the harmonious development of teacher-student relationship, and improve the participatory evaluation method system.

Data Availability

The figures and tables used to support the findings of this study are included in the article.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

References

[1] C. Che and H. Zeng, "College students' attitudes towards English online learning materials under the theory of autonomous learning," *Journal of Educational Institute of Jilin Province*, vol. 65, no. 18, pp. 35–74, 2019.

[2] F. Cheng, "Study of college students' online English deep learning based on constructivism," *Journal of Educational Institute of Jilin Province*, vol. 55, no. 13, pp. 26–54, 2018.

[3] Y. Zhang, "Research on college English online learning platform model based on big data technology," *Journal of Physics: Conference Series*, vol. 1648, no. 4, 2020.

[4] Q. Ma, M. Liang, Y. Wu et al., "Osteoclast-derived apoptotic bodies couple bone resorption and formation in bone remodeling," *Bone research*, vol. 9, no. 1, pp. 5–17, 2021.

[5] G. Xie, "An instructional model of online synchronous instruction—A case study of university English course for college students," *Frontiers of educational research: Chinese and English versions*, vol. 10, no. 3, pp. 8–21, 2020.

[6] N. Emelyanova and E. Voronina, "Introducing Blended Learning in the English Language Classroom: Students'

Hindawi
Journal of Environmental and Public Health
Volume 2023, Article ID 9761904, 1 page
https://doi.org/10.1155/2023/9761904

Retraction

Retracted: The Construct and Interpretation of Chelated Coordination Polymers and Their Use in Nanomaterials Research

Journal of Environmental and Public Health

Received 27 June 2023; Accepted 27 June 2023; Published 28 June 2023

This article has been retracted by Hindawi following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of one or more of the following indicators of systematic manipulation of the publication process:

(1) Discrepancies in scope
(2) Discrepancies in the description of the research reported
(3) Discrepancies between the availability of data and the research described
(4) Inappropriate citations
(5) Incoherent, meaningless and/or irrelevant content included in the article
(6) Peer-review manipulation

The presence of these indicators undermines our confidence in the integrity of the article's content and we cannot, therefore, vouch for its reliability. Please note that this notice is intended solely to alert readers that the content of this article is unreliable. We have not investigated whether the authors were aware of or involved in the systematic manipulation of the publication process.

Wiley and Hindawi regrets that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our own Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

References

[1] K. Abbas Omran, "The Construct and Interpretation of Chelated Coordination Polymers and Their Use in Nanomaterials Research," *Journal of Environmental and Public Health*, vol. 2022, Article ID 3937375, 13 pages, 2022.

Hindawi
Journal of Environmental and Public Health
Volume 2022, Article ID 3937375, 13 pages
https://doi.org/10.1155/2022/3937375

Research Article

The Construct and Interpretation of Chelated Coordination Polymers and Their Use in Nanomaterials Research

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Received 18 June 2022; Revised 2 July 2022; Accepted 5 July 2022; Published 10 August 2022

Academic Editor: Sivakumar Pandian

Presently, an important step from basic research to practical applications is synthesizing nanostructured materials. Metal-organic structures, as well as coordination polymers, are a diverse group of materials with a wide range of potential and properties applications. It has been difficult to get these materials into commercial use because of many drawbacks. Polymers containing chelated units are described and assessed for their advancements and problems in preparation, properties, and structure. Here, a proposed approach based on designing coordination polymeric materials with chelated units using the metal-ligand approach (CPM-CU-MA) has been introduced for a columnar-layered plan, supramolecular components, and building levels. Nanocomposite materials can be formed through the thermal transformation of coordination polymers based on donor atoms. The polymeric metal chelates (PMCs) are categorized according to luminescent coordination polymer (LCoP) development. It is classified as macrocyclic intracomplex, polynuclear, and molecular according to its macrostructure. Supramolecular networks (SMNs) can be transformed into a coordination polymer by introducing cyclo-dehydrogenation of natural building blocks on a surface. The structure-property connections of LCPs can influence a framework of liquid crystal display (LCP) that has been given based on LC phase modulators with a large modulation depth and has useful applications in LC lens. In the spatial organization of PMCs, the main focus is on the commonalities and contrasts between higher- and lower-molecular-weight chelates based on molecularly imprinted sensors (MISs) and nanomaterial sensors for a wide range of uses. New functional nanoparticles based on the molecular components have exciting potential, as demonstrated by these findings based on parameters risk factors for human health, hazards reduction in the environment, lack of cost-effectiveness, environmental sustainability, and bioavailability of polymers with an overall performance of 95.3%.

1. Introduction to Coordination Polymers

Recently, coordination polymers have received much attention as new metal-organic hybrid materials. There are various ways in which the organic ligand is connected to the metal ions and other metal-containing cluster nodes that make up the extended network [1]. Metal-organic structures or porous organic polymers are used to refer to CPs with perpetual porous structure [2]. CPs, on the other hand, are outstanding precursors for the creation of a new class of highly tunable polymeric nanoparticles for pumped storage, sensing, catalyst supports, pollutant adsorbents, and electrochemistry applications [3]. In nanomaterials, as redox-active materials offer new insights into electrostatic interaction in the cooperation space and show characteristics that could support future apparatus development, progress in this area is critical for fundamental research and applied research [4]. For the hydrogen evolution reaction (HER), CPs and their composites have recently received much attention because of their numerous advantages, reflecting the manufacturing community's urgent need to enhance chemical reliability and power storage advanced technologies performance [5].

There are many applications for coordination polymers that use their luminous properties. Luminescence is produced after stimulating the particles, ions, or molecules [6]. The substances and hydrothermal stability of CPs are among the most important characteristics of

nanomaterials. However, even with careful selection of metals and linkers, the coordination environment changes, and thus, the original structure is destroyed by redox reactions [7]. It is a well-known organic molecule with outstanding electro/photochromic and membrane processes relevant to electron appropriateness and oxidation activity [8]. The features of double-charged viologen derivatives are used as building blocks in the structure materials in these frameworks [9]. One of their strongest suits is the ability to form charge transfer (CT) systems species rich in electrons, such as substances, electronics, and photo-stimulated species [10].

CP metal bipyridinium's unique properties as a viologen compound inspire future functional studies [11]. In luminescence, CP metal bipyridinium is an excited state spontaneously consisting of photons from an excited state that can be generated in various ways, including photonic stimulation, mechanical stresses, and chemical/electrochemical responses [12]. To explain luminescence, a photon absorbs and then emits a photon, causing an electron to move from a ground state to an excited one and then back to a ground state again [13]. Nanomaterials and nanostructured polymers (NNPs) can be used to create electrochemical sensors that can be used in a variety of applications using SMN. Due to their high stability, short electro polymerization time, and high specificity toward the target molecule, MIPs-based electrochemical sensors have gained traction [14]. NNPs can be synthesized using various methods, and the most common are surplus and outer layer imprinting [15].

This method is the most widely used for printing polymers because it involves embedding a template molecule entirely in the matrix material and then removing the imprinted material completely after polymer chains [13]. There are many commercial polymeric materials and nanomaterials on the market today that are inert, and as such, surface modification is essential to boost their adherence and to soak properties by adding polar as well as other structural features to their surfaces [16]. According to commercial polymeric materials, the number of publications on nanomaterials and polymers has increased exponentially since their inception [17]. An interesting aspect of nanoparticles is their magnitude, structure, and surface morphology [18]. It is important to remember that microparticles tend to aggregate into materials, especially when improperly stabilized during the manufacturing and application processes [19]. However, nanomaterials have some undesirable side effects, the most notable of which is a change in the assimilation rate used to administer medication, fight diseases, and identify diseases [20]. Because of this, composites now have a wider range of potential applications due to the convergence of nanoscience with polymer science and technology [20]. Nearly every field in which polymers can be used has found new uses for these materials. An overview of the most recent developments in electrochemical sensing using MIPs and nanomaterials is provided in the following review.

The major contributions of this study involve the following points:

(i) Designing the nature of the donor atoms influences the classification of luminescent coordination polymers (LCoPs)

(ii) Supramolecular networks (SMNs) are introduced as a coordination polymer by cyclo-dehydrogenation of natural building blocks on a surface

(iii) The structure-property connections of LCPs based on LC phase modulators with a large modulation depth are implemented in the LCP framework

The remaining section of this study is given as follows: Section 2 deals with the historical background of the coordination of polymers, followed by the implementation of our proposed CPM-CU-MA method in Section 3. Sections 4 and 5 give the experimental analysis and conclusion with the future scope.

2. Related Works on Coordination Polymers

Because organic ligands can vary in their versatility, duration, and symmetry, the building elements of desirable frameworks can be greatly enhanced using chelates. An infinite array of metal ions is linked together in a coordination polymer by coordinated ligands. Given the significance of coordination polymers as an essential group of organic-inorganic hybrid materials for functionalizing inorganic substances such as micro or nanofillers with organic and/or inorganic molecules able to interact with organic matrixes to provide enhanced properties.

Capacitors based on cluster-based coordination polymers (C-CPs) have already shown commitment. Using thermal treatment reactions in laboratory settings, five additional new C-CPs based on organophosphates Strandberg-type clusters are synthesized at various ph levels to investigate the relationship between crystal lattice and capacitor achievement [21]. For our systematic analysis of the impacts of pH on CCP assembly, we isolated five compounds. For the first time, polyoxometalate groupings of organophosphates Strandberg type were explored as electrocatalysts.

Polymeric chains containing cubane-like CoII4L4 components and dicarboxylates (CoL-2CB) were synthesized and characterized using monocrystalline diffraction and total X-ray dispersion [22]. To produce cubane-like compounds with a moderate interfacial area of 17–49 m^2/g^{-1}, heavy rainfall is a quick and flexible method that allows surface chemical reactions, even though the powders are nonporous. Oxygen evolution reactions can be carried out using an amorphous cubane-like polymer.

A relatively new class of polyoxometalate-based coordination polymers (POMCPs) has already made significant strides in recent decades due to their remarkable structural characteristics and useful characteristics in photonics, electrodynamics, and organic photocatalyst [23]. Keggin-type POM derivatives such as these coordination polymers add structural variety. They often offer a way to design functional materials with exceptional properties guided by a structure-property correlation. Catalysis-related applications, as well as synthetic strategies, are indeed discussed.

The numerous antitumor activities induced by nitric oxide (NO) include induction and hypersensitivity to chemo- and radiotherapy (CDT). As a result, it has received much attention in cancer intervention [24]. This symbiotic NO-CDT effect has been shown to slow tumorigenesis. The effect of NO-CDT therapy and the simple and efficient strategy to build a cooperative polymer nanoparticle were both demonstrated in this study to enhance the precision of NO targeting and treatment efficacy. This is accomplished through simple precipitation and partial ion exchange.

Inorganic CPs (i-CPs) and organic CPs (o-CPs) are the two types of coordination polymers (CPs) proposed based on polycrystalline states and features as a recent research direction for CPs based on their successful crystal engineering by (i-o-CPs). Materials must be controlled in their liquid or translucent states [25], and this is to fine-tune the material's properties such as conductivity, transparency, and porosity. Liquid/glass o-CPs have a unique landscape that allows for characteristics and features to be developed that complement those found in the crystalline phase.

The problems risk factors for human health, hazards reduction in the environment, lack of cost-effectiveness, and environmental sustainability from the above research of C-CPs, CoL-2CB, POMCPs, NO-CDT, and i-o-CPs are compared and improved in our proposed method CPM-CU-MA which is implemented and analyzed in the following sections.

3. Proposed Coordination of Polymeric Materials with Chelated Units Using the Metal-Ligand Approach

When doing research with this kind of cutting-edge material, the interphase between the components becomes a crucial factor to take into consideration and will be centred in a coordination polymer, an inorganic or organometallic polymer structure. Here, in this study, a coordination polymer is extended based on a dimensional compound with repetitive coordination entities that are compared and analyzed. Chelated unit polymers are described and evaluated for advancements and problems in preparation, properties, and structure. Coordination polymeric materials are used in this approach.

3.1. Analysis 1: Designing the Nature of the Donor Atoms Influences the Classification of Luminescent Coordination Polymers (LCoP). Photonic stimulation, mechanical stresses, redox processes, and other mechanisms contribute to the complex phenomenon of luminescence, which involves the photoluminescence of radiation from an excited state. Various radiative and nonradiative relaxation processes are involved in the strategic luminescence mechanism, which involves an electron moving from the ground to an excited state by absorbing a photon and then returning to the ground state with concurrent state photons emitted shown in Figure 1.

Short excited state lifetimes (1–100 ns) are a result of fluorescence transitions, which occur from the excited state (es) to the resting state (rs). Because of this, the excited singlet (es) undergoes an intersystem crossing (ISC) to the energized triplet state (ts), followed by a forbidden photon-emitting transition back to the ground state (rs), which is equal to 1 longer. The molecular framework of CPs can explain the CPs' luminescence in the first place. Indeed, this method is often unable to account for all of the identified luminescence effects in their entirety, however, as shown in Figure 1.

$$\frac{\rho}{\mathrm{d}t}(\sigma CPe) - \frac{\rho}{\mathrm{d}t} cp \frac{ht^n * (es/rs)}{(mi * ol * ca)} = \begin{cases} n, & \\ ht^n * (es/rs), & \text{where } n \geq 0. \end{cases} \tag{1}$$

Most often, CPs exhibit emission lines *CPe* due to the presence of chelates *cp* that are coordinated to metal complexes or clusters by differentiation $\rho/\mathrm{d}t$ denoted in equation (1). A number of host molecules ht^n like solvent molecules can get intertwined in these structures $\rho/\mathrm{d}t\,(\sigma CPe)$, which can lead to emissions in CP in some cases $\rho/\mathrm{d}t cp\,(ht^n * (es/rs)/(mi * ol * ca))$. In this way, CPs with configurable luminescence can be synthesized through a careful selection of metallic ions *mi*, organic linkers *ol*, and cleaning agents *ca* that are entangled in one another $ht^n * (es/rs)/(mi * ol * ca)$, among other things by *n* value.

This group comprises lanthanide and actinide metals, commonly found in metal-centered luminescence (MCL). These compounds can reduce the risk factors for human beings, which can be compared in the following section. However, CPs with transformation and p-block metal cations have shown key transitions in luminescence in some cases, as illustrated in Figure 2. Metal-centered (MCT) emissions, based on d-d or f-f transitions, ligand-centered (LCT) emitters originating from organic ligands, and numerous charge transport emissions, such as ligand-to-metal charge transfer (LMCT), metal-to-ligand charge transfer (MLCT), ligand-to-ligand charge transfer (LLCT), and metal-to-metal charge transfer (MMCT) are among the most common mechanisms used in LCoPs.

$$ht^n * \frac{es}{rs} = \frac{\rho}{\mathrm{d}t}(mi) + \frac{\rho}{\mathrm{d}t}(ol) + \frac{\rho}{\mathrm{d}t}(ca) * \frac{n}{(1 - ht^n)}. \tag{2}$$

Based on their properties on *es*/*rs*, the nanoparticles will either be in oil or water. In the organic phase, hydrophobic nanoparticles are found, while hydrophilic nanoparticles ht^n are found in the liquid phase, identified using equation (2). It is possible to synthesize CPs with customizable luminescence by carefully selecting metallic ions $(\rho/\mathrm{d}t)\,(mi)$, organic likers $\rho/\mathrm{d}t\,(ol)$, and cleaning agents$\rho/\mathrm{d}t\,(ca)$. As shown in equation (1), the presence of chelates, which are coordinated to metal complexes or clusters $n/(1 - ht^n)$, causes emission lines to appear in CP materials through $ht^n * (es/rs)$.

CP syntheses, luminescence detection, and common luminescence sensing pathways are shown in Figure 2. Energy transfer occurs between donor and acceptor

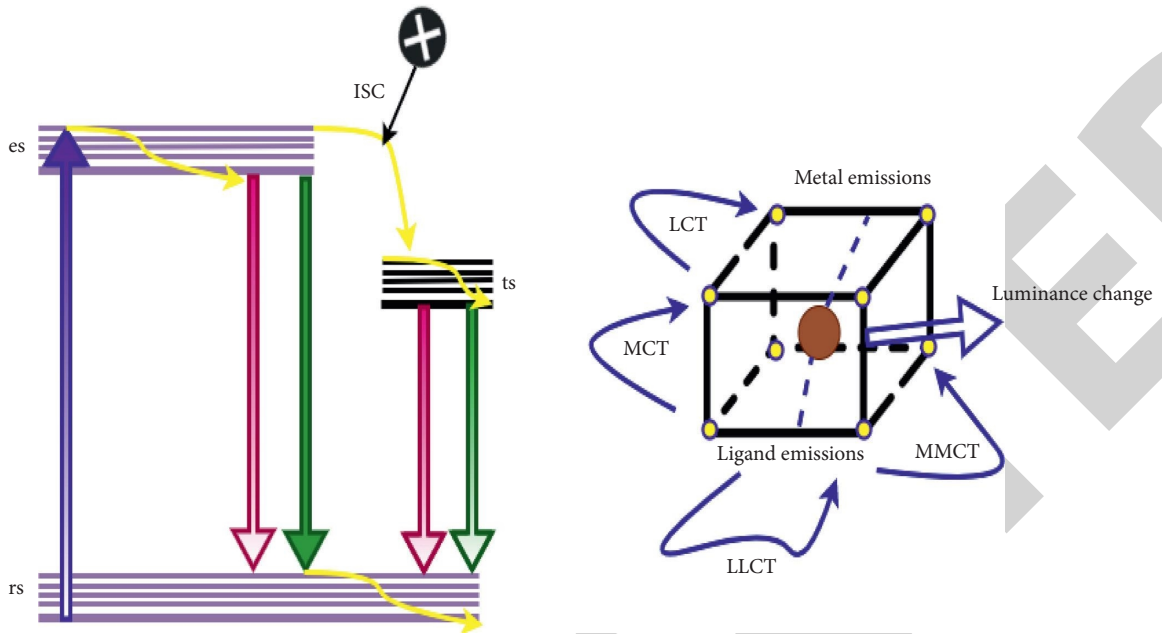

Figure 1: Mechanism and key transition in LCoPs.

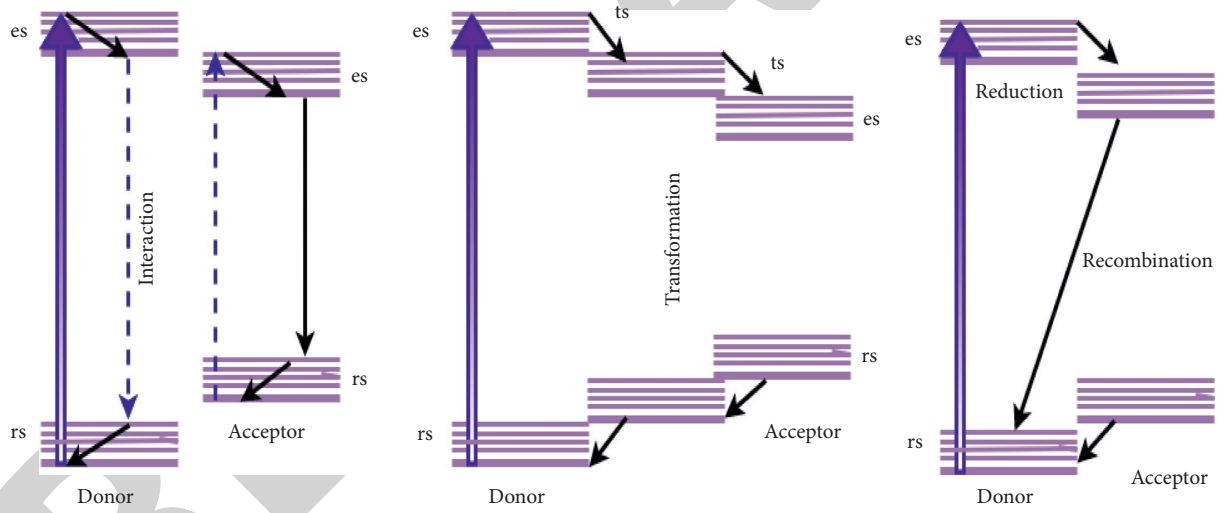

Figure 2: LCoP's general mechanism of detection.

molecular entity without the use of radiation. The fluorescence intensity and exciton lifetime of the donor decreased due to LCoP. In contrast, the acceptor's excitation state lifetime and emission frequency increased due to reduction and recombination. This method can study Coulombic interactions between molecules because it is distance-dependent. Electron transfer is a process in which excitons from donor particles are transferred to acceptor molecules via a nonradiative pathway, hydrating the luminescence of the donor particles. Thus, this mechanism can be used in situations where the donor and acceptor are in close proximity. It is possible to transfer electrons in a single or two-step process.

$$(nf) = \sum\sum \begin{cases} m * mi * ol * ci, \\ dc\dfrac{\rho}{\mathrm{d}t} * d(np_i - lr_i), \\ pr - (np_i - lr_i). \end{cases} \tag{3}$$

To better understand the movement of nanofluids (nf) in coordination found by Brownian, we used Brownian diffusion, as shown in equation (3), to reduce human hazards to environments and humans, compared with other methods as follows. The nanoparticle dispersion coefficient np is the density of nanoparticles $d(np)$ in interval I; the net

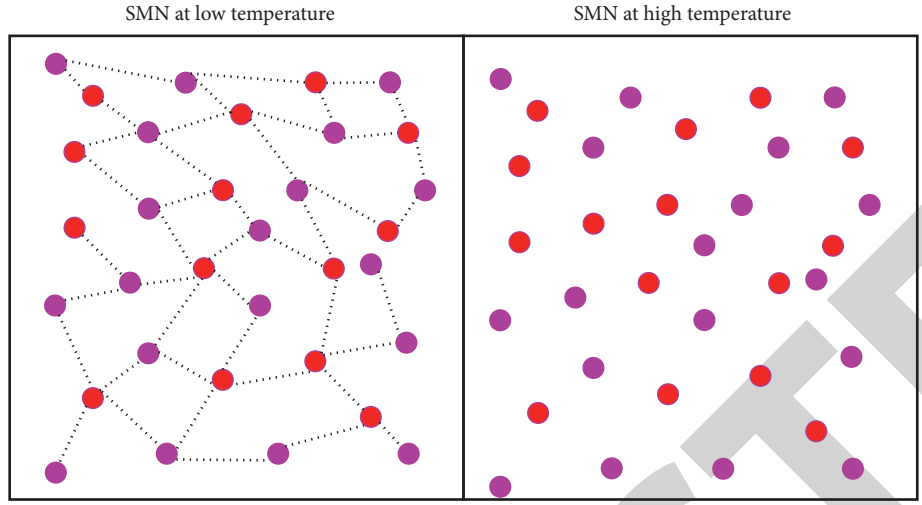

Figure 3: Diagrammatic representation of SMN.

loss ratelr is the intensity of nanoparticles in an interval $np_i - lr_i$ and through in phase $dc\,(\rho/\mathrm{d}t)$. The pores pr absorb nanoparticles as they move through $m * mi * ol * ci$ for hazard reduction. The massive loss rate of nanomaterials after modification must therefore be taken into account using the summation process $dc\,(\rho/dt) * d\,(np_i - lr_i)$.

$$dc\frac{\rho}{\mathrm{d}t} = rd * \begin{cases} mi * \left(1 - \dfrac{gm}{\max - gm}\right) + es, \\ li\left[\max - gm * \dfrac{\rho}{\mathrm{d}t}(li)\right] + lt, \\ ca\dfrac{\rho}{\mathrm{d}t}(1 - ht) * \dfrac{gm}{\max - gm} - er. \end{cases} \tag{4}$$

From equations (2) and (4), radiation $r\ d$ is needed to transfer energy from one molecule to another. During LCoP, the donor's absorption spectrum gm and exciton lifetime are maximized and given as $gm/(\max - gm)$ while the acceptor's excitation state es, longevity lt, and emission recurrence er continued to increase from equation (4). The presence of various metallic ions mi and groupings, ligand compounds li, and different configurations a formed by altering the synthetic circumstances $[\max - gm * (\rho/\mathrm{d}t)(li)]$ conversations between cross-linking frameworks $ca\,(\rho/\mathrm{d}t)(1 - ht) * (gm/\max - gm)$ constrained rotation in structures, guest molecules, and the method in which server and guest communication led to a complicated luminescence mechanism in CPs.

3.2. Analysis 2: Supramolecular Networks (SMNs) in Coordination Polymer by Cyclo-Dehydrogenation. Chemically bonded polymers linked by transitory, noncovalent bonds in supramolecular polymer networks exhibit properties such as stimuli attentiveness, identity, and structure, making them an intriguing class of soft materials. The major advantages of supramolecular polymer networks are based on the versatility of coordination polymer networks and the flexibility of physical bonding with chelates.

Polymer science has recently introduced a new nanomaterial that combines the flexibility of manufacturer synthetic connections with the redox potential. The versatility of physical bonding in a supramolecular network of polymers is given in Figure 3, with bonding and nonbonding structures based on low and high temperatures. To construct the network chains from noncovalently associating polymeric materials or to tie covalently joined and yet noncovalently associated polymer chains together, these supramolecular bonds such as hydrogen coordination polymers, p–p polymers, or metal chelates are used.

$$O(L, mi) = \frac{ht^n\,(cn)_{n+1}}{ps * \sum_{i=0}^{n} ht^n\,(cn)_n} * \begin{bmatrix} ra_{11} & ra_{12} & \cdots & ra_{1n} \\ ra_{12} & ra_{22} & \cdots & ra_{2n} \\ \vdots & \vdots & \cdots & \vdots \\ ra_{n1} & ra_{n2} & \cdots & ra_{nn} \end{bmatrix}. \tag{5}$$

It is possible to connect the organic O ligand to the metal ions (L, mi) and other cluster nodes $(cn)_{n+1}$ in the extended network ht^n from equation (1) in various ways from equation (5). Perpetual porous structures ps are referred to as metal-organic formations $\sum_{i=0}^{n} ht^n\,(cn)_n$ or highly permeable organic polymers by $n + 1$, respectively. Advances in redox-active ra materials in nanomaterials in matrices form $\begin{bmatrix} ra_{11} & ra_{12} & \cdots & ra_{1n} \\ ra_{12} & ra_{22} & \cdots & ra_{2n} \\ \vdots & \vdots & \cdots & \vdots \\ ra_{n1} & ra_{n2} & \cdots & ra_{nn} \end{bmatrix}$ are essential for both fundamental and applied research because they provide new insights into an iconic attraction in the cooperation storage (cn) and pressure coefficient $ht^n\,(cn)_{n+1}$ that may support future apparatus development.

$$ps = -\frac{1}{\log(n)} \sum_{i=0}^{n} st(nm) \times \log(st(nm)) + O(L, mi). \quad (6)$$

Some of these carbon-based rigorous aromatic binding sites $(st(nm))$ may be detrimental to humans and the environment by $\sum_{i=0}^{n} st(nm) \times \log(st(nm))$ being useful in the preparation of rigid connections with internal surface area.

$$E(S_R) = \frac{1}{\log\ (ht)} \sum_{i=1}^{n} \left[sp\left(hs_n^i, hp^i\right) + \frac{1}{\sqrt{\log(n)}} \left(hs_n^i, hp^i\right) \right] - sp. \quad (7)$$

To create electrochemical sensors $E(S_R)$ that can be used in a wide range of applications, nanomaterials can be used as $1/\log(ht)$. This sustainability of electrochemical sensors has become popular because of their high stability hs_n^i, short polymers time sp, and high precision hp^i as $sp(hs_n^i, hp^i)$ for the target molecule may be stated as $1/\sqrt{\log\ \log(n)}\,(hs_n^i, hp^i)$ and can be calculated from the above equation by the combination $[sp(hs_n^i, hp^i) + (1/\sqrt{\log\ \log(n)}\,)(hs_n^i, hp^i)]$ (7).

As shown in Figure 4, the degree of supramolecular polymers is directly proportional to the chelating constant. Supramolecular polymers based on bifunctional cyclo-dehydrogenation can improve their carbon atoms and macromolecular lifeforms by increasing the polymeric coordination concentration. Due to this combined effect, the supramolecular chain molecules become entangled at a certain concentration. A true chelation transition is observed at critical concentrations in systems that can form implicit nodes with a feature greater than two.

$$\frac{lg}{scm} = ts \frac{\exp\left(mc * m^2 c\right)}{(1 - rm) \int mAb} * \sum_{i=1}^{n} ma. \quad (8)$$

For example, those formed by polymeric materials modified to be dehydrogenation or basic components constituted of transition metals to remove the risk factors for human health, reduce environmental dangers and lack of cost-effectiveness as shown in Figure 5. Metal-chelating polymers (MCPs) play a critical role in mass cytometric mc based on multimode chemiluminescence m^2c and the ligands lg in CPs are made up of both synthetic compound's modules scm. Each metal atom ma in the polymer is carried by the polymer mentioned in equation (8) in the form of noble metals $\sum_{i=1}^{n} ma$, and the polymer's reactionary functionality $\exp(mc * m^2 c)$ is used to attach the radioactive metal materials rm to the monoclonal antibody mAb using integration as $(1 - \mathbf{rm}) \int \mathbf{mAb}$. It is possible to have two or even more donor atoms form covalent bonds with two or more different parts of the ligand to create a chelating ligand, given as the combination $\mathbf{exp}(\mathbf{mc} * \mathbf{m}^2\mathbf{c})/(1 - \mathbf{rm}) \int \mathbf{mAb}$. It could be said that these are multivalent ligands or ligands with multiple donor sites, depending on the context.

3.3. Analysis 3: The Structure-Property Connections of LCPs Based on CPs Phase Modulators with a Large Modulation

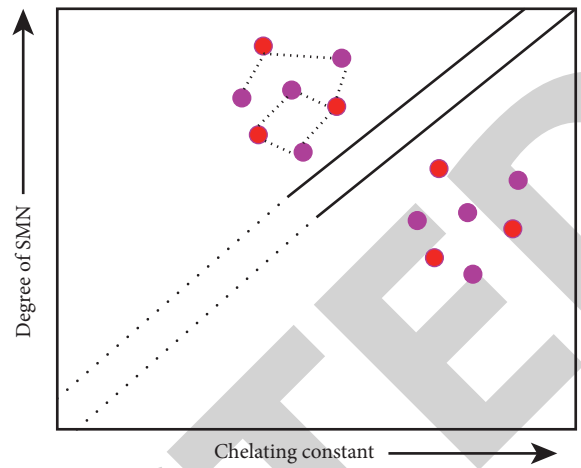

Figure 4: Comparison of SMN with chelates.

Framework. Polymer fibers, waveguides, supercapacitors, contour memory, surface functionalization, storage systems, electric motors, and more use LCPs because of their superior properties and wide range of applications. CPs can combine the major area of LCP in the chelating process, and the relation between them is illustrated in Figure 6.

Fast response and massive phase modulation intensity can be achieved using coordination polymer network liquid crystals; however, these cells are highly scattered in the visible spectrum. Indium-tin-oxide is being used to coat both substrates' inside surfaces, and there is no need for an alignment layer depicted in Figure 6. In this two-step procedure, 365 nm ultraviolet radiation light highlights the cell in the electrode with a voltage (v). A mismatch in the refractive index between the randomly distributed LC and the CP caused the cell to be transparent immediately following the curing process. As a final step, the upper substrate is sheared with precision, and the length between the shears is 350 m. Since the LC molecules are all aligned in the same direction, the cell became transparent.

$$pr(nm_s) = \sum_{i=-\infty}^{\infty} (nc_m - Sm_s) + \sum_{i=-\infty}^{\infty} \left(mc * m^2 c\right)\left(2^{(mc/2)} * (nc_m - Sm_s)\right), \quad (9)$$

$$\sum_{i=-\infty}^{\infty} \left(mc * m^2 c\right) = 1 - \left(2^{mc/2} * (nc_m - Sm_s) * \frac{mc}{\sqrt{(1 - rm) \int mAb}} \right). \quad (10)$$

As precursors pr for the development of nanocomposite materials (nm_s), CPs are increasingly in demand because they serve as a starting material Sm_s and stabilizers $(nc_m - Sm_s)$ for the nanoparticles that are formed using multimode chemiluminescent from equation (8) $(mc * m^2 c)$. When it comes to designing new materials like $2^{mc/2}$, the use of solid-state thermolysis with infinity limits through summation

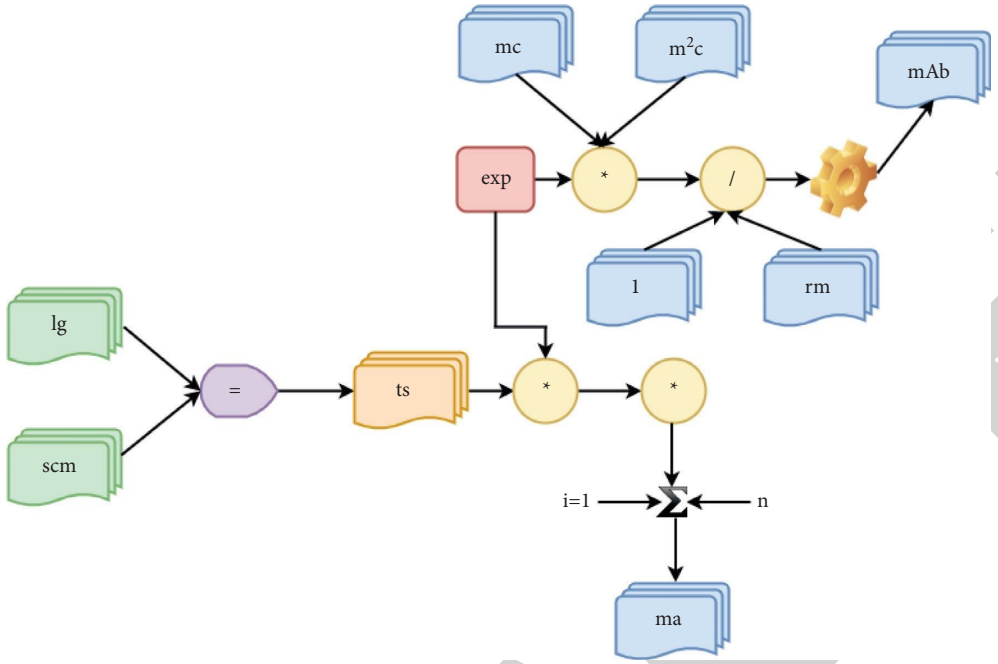

Figure 5: Path flow process of MPC in CPs.

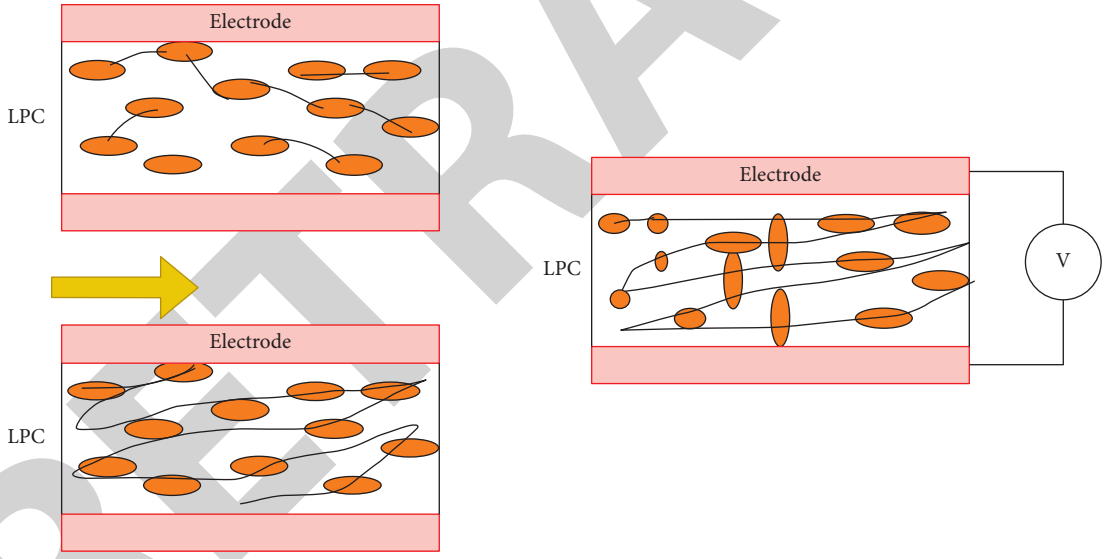

Figure 6: Representation of shearing LPC in CPs.

$\sum_{i=-\infty}^{\infty}(\mathbf{mc} * \mathbf{m^2c})$ to create new nanostructures is a straightforward and logical method using equation (9). Numerous studies for the analysis of the cost-effectiveness of thermal decomposition $(2^{mc/2} * (nc_m - Sm_s))$ of CPs have been carried out to produce different types of nanomaterials with the desired sizes, and morphological characteristics are denoted by $\sum_{i=-\infty}^{\infty}(\mathbf{mc} * \mathbf{m^2c})(2^{\mathbf{mc}/2} * (\mathbf{nc_m} - \mathbf{Sm_s}))$ to the monoclonal antibody *mAb* for the analysis of the bioavailability of polymers in equation (10).

The comparison of LPC switching time in two phases is shown in Table 1. There are five levels of phase retardation, and 100–10% phase shift is used to describe the system performance. For various applications, the operating temperature of LC devices can vary greatly. However, many of the CP's characteristics of LC content are strongly influenced by the temperature at which they are used. This necessitates further investigation into the LPC's temperature effects. The rise from the first phase to the second phase takes the longest (745 s). As a result, the rise time is directly related to the voltage switching, for a reduced voltage switch is usually associated with a small phase transition.

Carbon-based nanostructured polymers and their diverse biochemical applications, from inorganic to organic molecules, are the subject of various research. Aside from a host of advantages, including specificity and sensitivity, MIPs have a few drawbacks, including loss of permeability,

Table 1: Comparison of switching time of LPC in two phases.

Response time		Second phase				
		0	1	2	3	4
First phase	**0**		745	400	330	206
	1	289		531	349	210
	2	310	386		394	215
	3	359	379	430		489
	4	408	370	442	267	

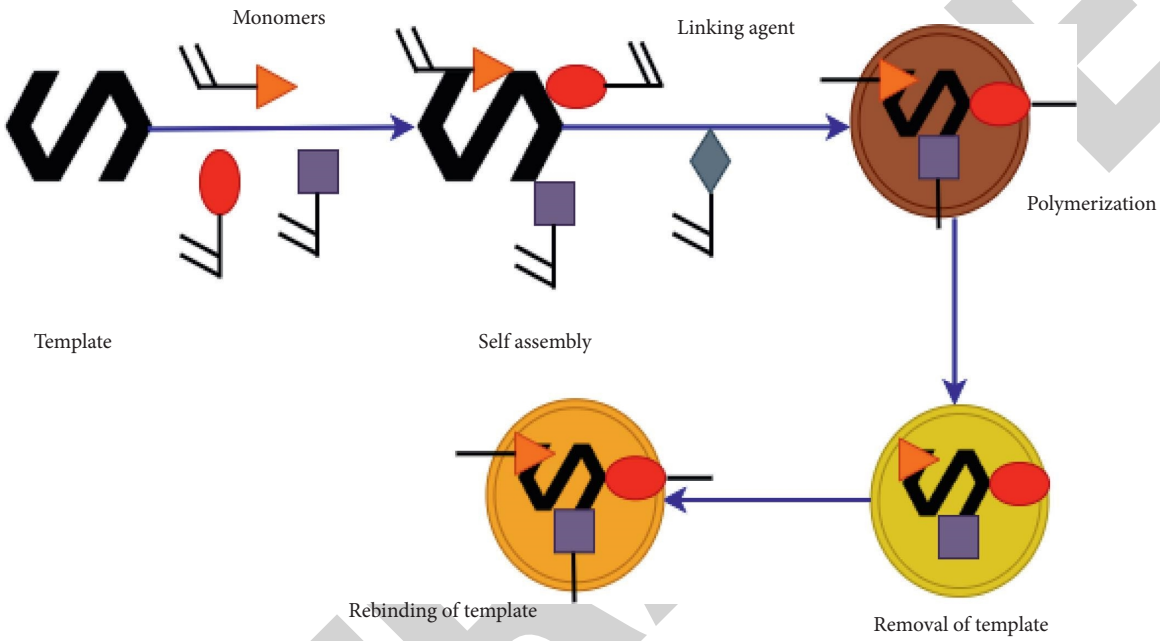

Figure 7: The process involved in MIPs.

catalytic performance, and a price that limits their use in various fields, which are overcome in our proposed technique with the implementation of CPs.

MIP scan recognizes molecules because of the presence of a pattern in the synthesis process that involves polymerization. During MIP self-assembly, specific binding occurs between the MIP and the template molecules through linking agents with monomers, as illustrated in Figure 7. Antibodies and proteases can be imitated using these synthetic receptors by removing templates. MIPs had many advantages, including their ability to be robust, stable, and low cost to prepare, as well as their ability to recognize specific analytes by rebinding the template with a high degree of sensitivity to those analytes. Bioanalytical methods and sensors both rely on MIPs because of their excellent selectivity and selectivity for sample processing. Because of their low cost and ease of preparation, MIPs can be used as chemically synthesized receptors for recognition in electrochemical sensors.

$$EC_s = NM + MP + \frac{1}{wl},$$

$$\mathbf{Tr} = \frac{|\mathbf{NM} + \mathbf{MP}|}{\boldsymbol{\pi}} = \sqrt{\mathbf{EC_s}}\left(\frac{\mathbf{mc}}{\sqrt{(1 - \mathbf{rm}) \int \mathbf{mAb}}}\right). \quad (11)$$

It is normalized NM to the same value measured in a monoclinic phase MP here. For the sample's transmittance Tr to decrease, the wavelength $1/wl$ must be reduced by $NM + MP + (1/wl)$. The operating temperature of LC devices is analyzed by the squared value of $\sqrt{EC_s}$ and can vary widely depending on the application of phase difference as $(|NM + MP|)/\pi$. Many of the EO characteristics of LC material $\sqrt{\mathbf{EC_s}}(\mathbf{mc}/(\sqrt{(1 - \mathbf{rm}) \int \mathbf{mAb}}))$, on the other hand, are highly dependent on temperature through equation (11) as $Tr = (|NM + MP|/\pi)$.

Analytical chemistry's field of nanotechnology has recently risen to prominence. Comprehension, control, and influence of matter at the nanoscale level in creating nanomaterials, devices, and structures are known as nanoscale design. It is transparent that the proposed MIPs have several advantages over traditional MIPs, including their ability to bind quickly and effectively to specific analytes, their ability to be magnetically attracted, and their shorter pretreatment time. Electrochemical sensing uses magnetic nanoparticles because of their separation and preconcentration characteristics, poor bioavailability, ease of preparation, and low cost for support fundamental decorated nanostructured polymers. MIPS-based electrochemical sensors employ nanomaterials in two primary ways. As shown in Figure 8, they can be used as core materials in the synthesis of MIPs, or electrode surface modifiers, to

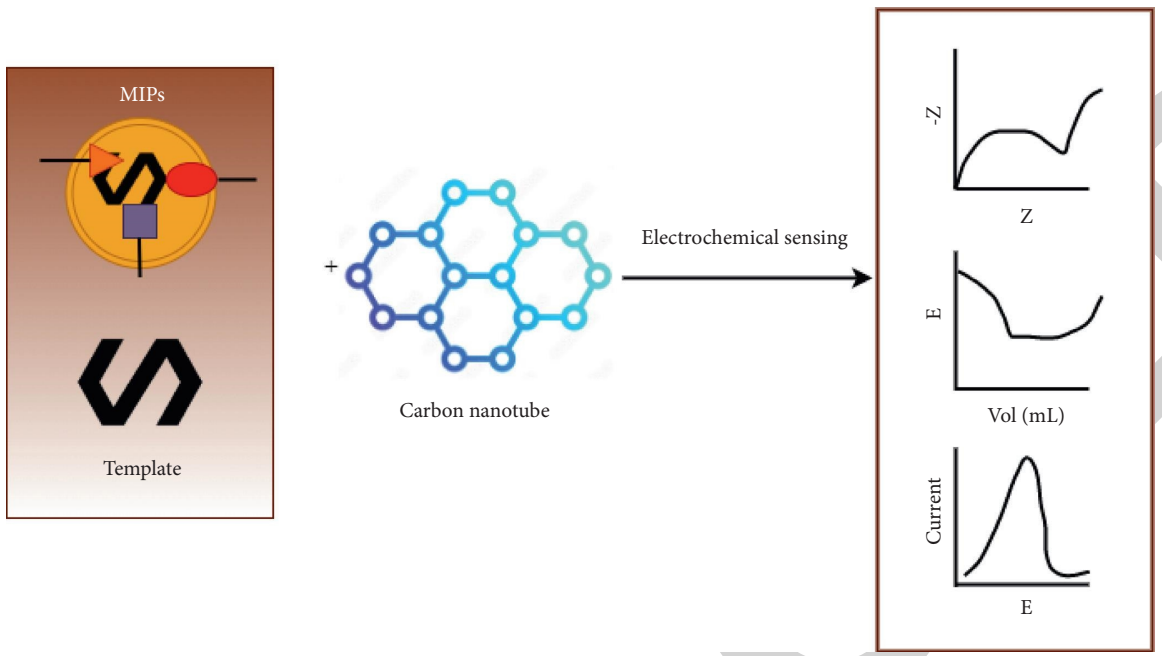

Figure 8: Schematic representation of template in MIPs.

enhance and enlarge the electrochemical notification due to their high reflectivity and large surface area. Nanomaterials combined with MIPs for electrochemical sensing are the focus of this review.

$$MP = ec_i ht_{i-1}^{ps} \sqrt{EC_s} ht\left(2\left(ps_{i-1}\right) * \left(pS_{i-2}\right)\right). \quad (12)$$

By now, many approaches to MOF synthesis have been developed, which are usually conventionally divided into two big groups: conventional synthesis and alternative synthesis methods. These are compared using equation (12) based on the overall performance of polymers. Traditional electric combustion ec_i without parallel processingEC_s is referred to as conventional synthesis, a term used to describe reactions that do not require heating $\sum_n ht_{i-1}^{ps}$. When a reaction contains strong water $2(ps_{i-1})$ and a ligand mixture $*\ (pS_{i-2})$, the solution is added to dissolve the salt and ligand mixture by $\sqrt{EC_s} ht\left(2\left(ps_{i-1}\right) * \left(pS_{i-2}\right)\right)$, which is the most common method for making MIPs.

Although many others have been reported, the most widely used methods for synthesizing MIPs are plentiful and outer layer imprinting. When it comes to imprinting polymer composites, the most common method relies on the principle of completely imprinting the template molecule into the polymer matrices and then removing it completely after polymerization.

From the above implementation, our proposed method CPM-CU-MA has a result enhanced by overcoming all the issues in the other traditional methods, C-CPs, CoL-2CB, POMCPs, NO-CDT, and i-o-CPs, to optimize the result with improved parameters risk factors for human health, hazards reduction in the environment, lack of cost-effectiveness, and environmental sustainability.

Table 2: Input parameters.

Factors	Metrics
Data provider	250
Frequency maximum	18.276 (MHz)
High surface area	Porous CPs
Capacity	250 MB
Simulation time	$T = 1{,}150{,}970$ ns
Bandwidth	512 mbps

4. Results and Discussion

As a means of enhancing, changing, or bestowing CPs with specific functions, postsynthetic reconfiguration can be an important option. LCoP modification can add new properties to CPs by modifying the functional groups, which can be classified as either organic or inorganic metal. Here, the comparison of the implemented result of CPM-CU-MA is made with other existing approaches using a dataset from the link [26] based on the parameters which are mentioned in Table 2.

4.1. Risk Factors in Human Health Analysis. Polymers are less toxic to humans than the subunits they contain, although they are still harmful to the environment. Polymeric materials and their decomposition products can discharge hazardous dust and fumes when cut, warmed, or otherwise manipulated using equation (1). CPs (σCPe), which contain vinyl acetate, may have negative effects on the cardiovascular system, peripheral nerves, and liver. In addition to their role in everyday activities like food storage, public transit, communication, medicine, nutrition, and recording history, polymers—natural and synthetic—play a significant role in enhancing human well-being and enhancing the quality of

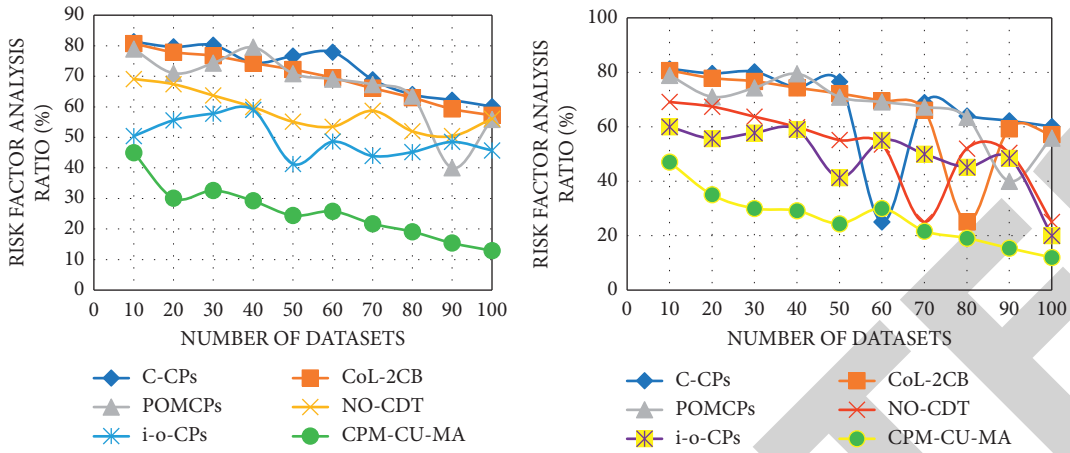

Figure 9: Risk factor analysis of CPs.

Table 3: Hazards reduction comparison.

Number of datasets	C-CPs	CoL-2CB	POMCPs	NO-CDT	i-o-CPs	CPM-CU-MA
10	81.3	80.7	78.9	69.1	50.4	30.7
20	79.6	77.9	71.0	67.4	55.6	30.1
30	80.2	76.7	74.3	63.7	57.8	32.6
40	74.4	74.3	79.5	59.9	59.0	29.2
50	76.6	72.2	70.9	55.1	41.3	24.4
60	77.9	69.5	69.1	53.5	48.6	25.8
70	68.9	66.1	67.3	58.7	43.9	21.7
80	64.0	63.0	63.5	52.0	45.2	19.1
90	62.2	59.3	59.0	50.4	48.5	15.4
100	60.1	57.2	55.9	56.1	45.7	12.9

everyday life (Figure 9). The nanoparticles are formed instantly because of the widespread introduction $ht^n * (es/rs)$ of the suitable solvent into the aqueous medium, which causes the water molecules to be avoided. A nanosphere-sized polymer induces the solution as it diffuses out of the nanoparticles.

4.2. Hazards Reduction in the Environment. Based on Table 3, the skin, lungs, and digestive system are the entry points for nanoparticles into the body. Free radicals, which can damage cells, may be generated as a result. There is concern that nanoparticles will cross barriers once they are in the bloodstream. Polymers must be made less flammable and their harmful thermal degradation products controlled using equation (3). Traditional flame retardants have proven to be effective, yet they have been shown to cause significant harm to health and the environment. It is possible to significantly improve the flame retardant properties of multifunctional polymers and composites by chemically or physically fusing carbon nanoparticles with other substances or samples containing phosphorus and nitrogen. Polymers can indeed improve the thermal and mechanical properties and result in multifunctionality such as electrical and thermal conductivity without compromising the mechanical characteristics of the polymers.

4.3. Lack of Cost-Effectiveness Analysis. Researchers can estimate the long-term financial and health-related benefits and costs of multiple interventions by combining data from different sources, such as a patient's natural history and clinical effectiveness, the health-related standard of living, and resource consumption. As shown in Figure 10, researchers can compare two or more potential alternative systems in the context of their health and financial repercussions. The values are represented as an additional cost ratio of differences in expense between two invasive procedures compared to their respective variations in the health and economic consequences of each.

4.4. Bioavailability of Polymers. Different novel delivery systems, such as lipid nanoparticles, macropinosomes, nanoemulsions, and lipid-based mechanisms, can improve bioavailability by accelerating the amount of release and the capacity to cross liposome biomembranes, such as those found in the body, as compared in Table 4. There are a number of ways in which drugs can be administered, and this represents the percentage of the total intake that is absorbed into the bloodstream, representing the bioavailability of CPs from equation (10). The phrase oral bioavailability refers to the ability of a drug or other substance to be absorbed and utilized by the body when taken orally.

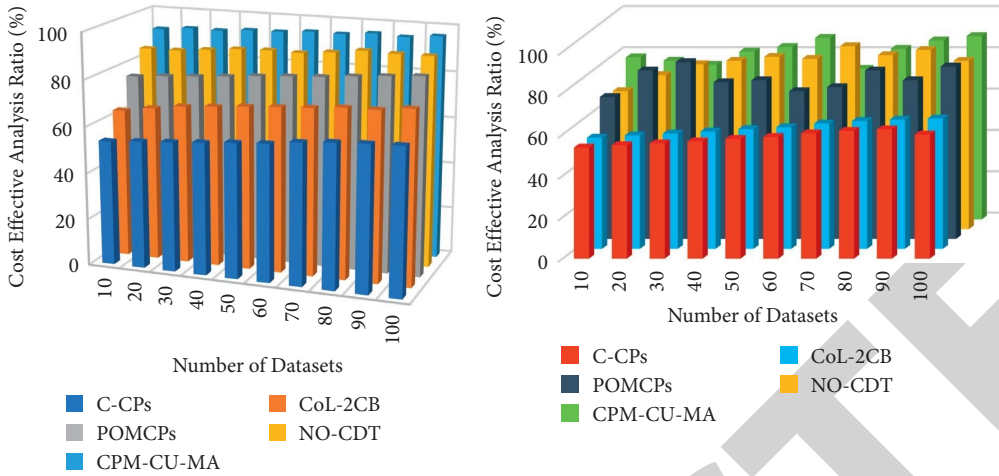

Figure 10: Cost-effectiveness analysis.

Table 4: Comparison of availability of polymers.

Number of datasets	C-CPs	CoL-2CB	POMCPs	NO-CDT	i-o-CPs	CPM-CU-MA
10	44.2	47.5	57.6	65.3	59.3	71.2
20	54.3	69.4	67.8	64.8	67.8	76.5
30	54.5	79.4	70.5	78.2	65.2	88.9
40	72.6	72.5	73.7	73.3	78.5	89.7
50	44.7	53.9	76.5	75.7	79.3	85.1
60	42.8	54.8	58.4	68.8	73.1	83.9
70	49.4	45.7	57.3	57.6	70.2	79.2
80	59.3	56.7	60.2	72.2	75.4	87.3
90	67.2	76.6	77.1	84.7	86.7	92.3
100	63.1	75.7	89.2	87.9	89.8	95.6

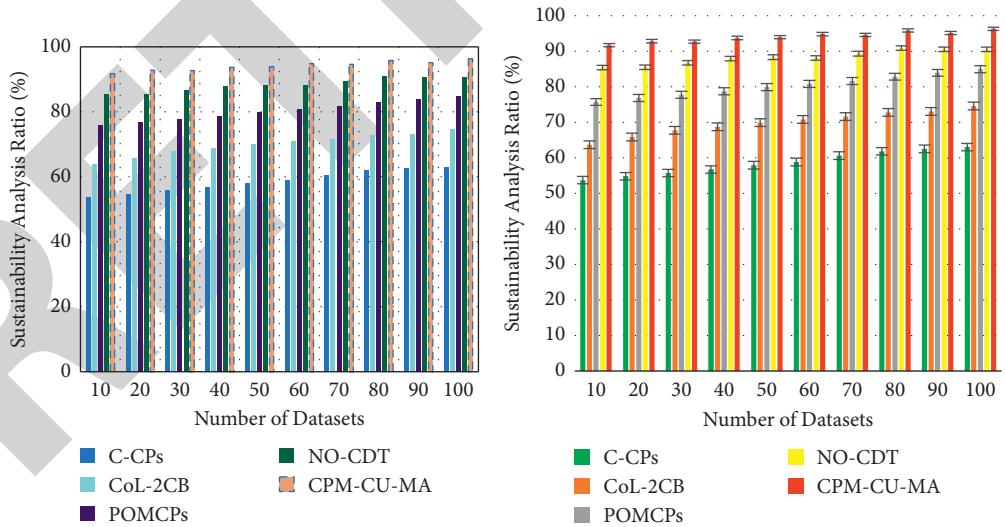

Figure 11: Environmental sustainability comparison.

4.5. Environmental Sustainability. As an environmentally, health, and economic impact-neutral plastic, a sustainable polymer meets consumer demands without compromising our natural resources. This research activity has intensified environmental sustainability due to the volume of overspending it generates. Environmental issues are increasingly being addressed using biopolymers using equation (7). Both the processability and the end-use application are still inferior to their competitors. When it comes to increasing the biopolymer's flexibility and impact resistance, mixing is currently a very cost-effective strategy as shown in Figure 11. Furthermore, conventional polymers are derived from fossil fuels. They have a long half-life in the environment, raising concerns about environmental sustainability and resource depletion.

Table 5: Overall performance of CPM-CU-MA.

Number of datasets	C-CPs	CoL-2CB	POMCPs	NO-CDT	CPM-CU-MA
10	53.7	63.7	75.7	85.4	91.7
20	54.8	65.8	76.8	85.5	92.8
30	55.7	67.7	77.7	86.7	92.7
40	56.7	68.7	78.7	87.9	93.7
50	57.9	69.9	79.9	88.3	93.9
60	58.8	70.8	80.8	88.1	94.8
70	60.6	71.6	81.6	89.3	94.6
80	61.8	72.8	82.8	90.9	95.8
90	62.5	73.0	83.9	90.5	95.1
100	63.0	74.6	84.9	90.5	96.3

4.6. Overall Performance Comparison of CPM-CU-MA. A wide range of nanomaterials that can be formed during thermal transformations of CP is the main component of LCoP. Constructions and coordination polymers with a wide array of synthetic methods, expandability, and appropriate premium ratios provide a methodological platform to build new promising materials, including metal nanoparticles, based on CP are compared and shown in Table 5. Biopolymers made from renewable resources are a sustainable alternative to petroleum-derived polymers, and they can help in reducing the carbon footprint of a product, achieved using equation (12). All the existing approaches are compared with our proposed method CPM-CU-MA and achieve enhanced output.

From the tables and figures, our proposed method CPM-CU-MA is compared with other conventional methods, C-CPs, CoL-2CB, POMCPs, NO-CDT, and i-o-CPs to analyze the enhancement of parameters like risk factors for human health, hazards reduction in the environment, lack of cost-effectiveness, environmental sustainability, and overall performance of 95.3%.

5. Conclusion

Recent years have seen an increase in the implementation of environmental CP materials. An encouraging development is the appearance of novel compounds that combine bio-based metal ligands with abundant elements. MIPs and LCoPs series show that completely safe and sustainable CPs can be made. There is little concern for the long-term sustainability of new CP materials. However, many of these materials are intended for environmental, energy, and other sustainable applications and are implemented in our proposed method CPM-CU-MA. Greater focus on CPs built with sustainable materials and green synthetic processes has enormous potential and a powerful social imperative. CPs must therefore demonstrate that they can at least equal or, better yet, outcompete current alternatives. This is a significant obstacle. Thousands of CPs have been found, and many of them have still proven to be interesting as a source of curiosity differently. The enhancement of parameters like risk factors for human health, hazards reduction in the environment, lack of cost-effectiveness, environmental sustainability, and overall performance of 95.3% is implemented. CPs' formability and responsiveness to luminaires, such as solar energy, could be useful in light-based applications and are considered a future scope of this study.

Data Availability

The data underlying the results presented in the study are included within the manuscript.

Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

References

[1] J. Q. Liu, Z. D. Luo, Y. Pan, A. Kumar Singh, M. Trivedi, and A. Kumar, "Recent developments in luminescent coordination polymers: designing strategies, sensing application and theoretical evidences," *Coordination Chemistry Reviews*, vol. 406, Article ID 213145, 2020.

[2] Z. Chen, S. Zhang, S. Zhang, Q. Sun, Y. Xiao, and K. Wang, "Cadmium-based coordination polymers from 1D to 3D: synthesis, structures, and photoluminescent and electrochemiluminescent properties," *ChemPlusChem*, vol. 84, no. 2, pp. 190–202, 2019.

[3] J. K. Sun, X. D. Yang, G. Y. Yang, and J. Zhang, "Bipyridinium derivative-based coordination polymers: from synthesis to materials applications," *Coordination Chemistry Reviews*, vol. 378, pp. 533–560, 2019.

[4] A. Hasan Hameed, E. Annon Mousa, and A. Abdullah hamad, "Upper limit superior and lower limit inferior of soft sequences," *International Journal of Engineering & Technology*, vol. 7, pp. 306–310, 2018, þ.

[5] J. X. Li, Z. X. Du, L. Y. Xiong, L. L. Fu, and W. B. Bo, "Supramolecular isomerism in two nickel (II) coordination polymers constructed with the flexible 2-carboxy-phenoxy acetate linker: syntheses, structure analyses and magnetic properties," *Journal of Solid State Chemistry*, vol. 293, Article ID 121799, 2021.

[6] D. Li, P. Ma, J. Niu, and J. Wang, "Recent advances in transition-metal-containing Keggin-type polyoxometalate-based coordination polymers," *Coordination Chemistry Reviews*, vol. 392, pp. 49–80, 2019.

[7] J. Li, M. Yi, L. Zhang, Z. You, X. Liu, and B. Li, "Energy-related ion transports in coordination polymers," *Nano Select*, vol. 3, no. 2, pp. 261–279, 2022.

[8] T. Gorai, W. Schmitt, and T. Gunnlaugsson, "Highlights of the development and application of luminescent lanthanide-based coordination polymers, MOFs and functional

Hindawi
Journal of Environmental and Public Health
Volume 2023, Article ID 9790238, 1 page
https://doi.org/10.1155/2023/9790238

Retraction

Retracted: A PCA-DEA-Based Model for Assessing the Sustainability of Marine Economy

Journal of Environmental and Public Health

Received 27 June 2023; Accepted 27 June 2023; Published 28 June 2023

This article has been retracted by Hindawi following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of one or more of the following indicators of systematic manipulation of the publication process:

(1) Discrepancies in scope

(2) Discrepancies in the description of the research reported

(3) Discrepancies between the availability of data and the research described

(4) Inappropriate citations

(5) Incoherent, meaningless and/or irrelevant content included in the article

(6) Peer-review manipulation

The presence of these indicators undermines our confidence in the integrity of the article's content and we cannot, therefore, vouch for its reliability. Please note that this notice is intended solely to alert readers that the content of this article is unreliable. We have not investigated whether the authors were aware of or involved in the systematic manipulation of the publication process.

Wiley and Hindawi regrets that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our own Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

References

[1] H. Yao, J. Huang, and J. Li, "A PCA-DEA-Based Model for Assessing the Sustainability of Marine Economy," *Journal of Environmental and Public Health*, vol. 2022, Article ID 2412588, 7 pages, 2022.

Hindawi
Journal of Environmental and Public Health
Volume 2022, Article ID 2412588, 7 pages
https://doi.org/10.1155/2022/2412588

Research Article

A PCA-DEA-Based Model for Assessing the Sustainability of Marine Economy

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Received 14 June 2022; Revised 7 July 2022; Accepted 14 July 2022; Published 8 August 2022

Academic Editor: Sivakumar Pandian

One of the most important and continuously growing research areas in marine ecology is assessing the sustainability of ecosystems. The concept is traditionally approached by quantifying different anthropogenic pressures, such as top-down effects, overexploitation, invasive species, overfishing, and pollution. However, this perspective has been criticized for its inability to capture the complex interactions between natural factors (such as climate change), human factors, and sociopolitical factors that shape ecosystems. In this paper, we present a new structural model for assessing the sustainability of marine ecosystems, PCA-DEA-based model, as an extension to current models that incorporates these key interfaces into dynamic system modeling by including trade-offs on horizontal scales (e.g., decision making).

1. Introduction

The term "sustainability" has become a widely used concept in relation to the management and conservation of natural resources. The central aspect of sustainability is commonly considered to be maintenance of ecosystem services and social-ecological system (SES) functions over time. However, maintaining ecosystem services and SES functions requires managing the driving forces that affect them in a way that they do not collapse or become unsustainable.

The ideal situation would be to keep SES functions while limiting or even avoiding anthropogenic pressures (such as pollution and habitat destruction) that could threaten those functions. This, however, is quite a difficult task to achieve in the face of economic and sociopolitical pressures. Sustainability therefore depends on the interaction between different levels of scale and the decisions that we make at each level. In particular, it is crucial to pay attention to symbiotic relations between humans and nature that are embedded in complex social-ecological systems [1–3].

Human activities can have a profound impact on biodiversity, ecosystems, and SES functions [4]. We may be struggling against threats such as overfishing or pollution but also for reasons that are not necessarily anthropogenic. Climate change, for example, might emerge as a major threat to marine ecosystem sustainability over the coming years. In fact, researchers from the University of Victoria recently argued that climate change is one of the most important factors shaping marine ecosystems and that the effects are already observable (see http://marine-ecology.com/2013/03/13/climate-change-marine-ecosystems).

To support sustainable management decisions in this complex social-ecological system, we need models that are capable of simultaneously incorporating various drivers and their interactions into one system analysis framework. In this paper, we present a new approach for analyzing marine ecosystems and the sustainability of their SES functions. Unlike traditional models, this approach incorporates the major factor of decision making into the system process.

This new approach is based on a multi-criteria decision making (MCDM) framework that allows for an integrated assessment of sustainability issues and management strategies. In particular, we present a PCA-DEA-based model (PCA stands for Principal Components Analysis, and DEA stands for Dynamic Evolutionary Algorithm) that assesses the sustainability of marine economy. This model is an

extension to current models that incorporates these key interfaces into dynamic system modeling by including trade-offs on horizontal scales [5–7].

The rest of the paper is structured as follows. We first give a brief introduction to the key concepts in MCDM and PCA-DEA modeling in Section 2. Section 3 presents the model structure, and Section 4 illustrates the application of the model in a case study. We conclude with our main findings in Section 5.

1.1. MCDM Model. The basic idea behind MCDM analysis is to develop a comprehensive assessment of sustainability issues by simultaneously incorporating various drivers (e.g., fishing pressure, trawling) and their interactions into one model framework. The key inputs to MCDM are the relationships between key drivers (e.g., current fisheries intensity, trawling). However, these relationships are subject to change due to changes in human behaviour or even wildlife migration or through bottom-up impacts (bottom-up effects).

The model used in this paper is based on partial least square-discriminant analysis (PLS-DA) and differential evolution (DE). The model, however, is designed as a flexible tool that can be modified to fit a wide range of systems. It can be used to assess the impact of different drivers on different SES functions or evaluate critical points where trade-offs arise between two or more of them.

2. Method

The general idea behind the model is that it can be used to evaluate trade-offs between different components (such as SES functions or pressure) using a structural equation modeling (SEM) framework. SEM provides an effective tool for testing causal relationships among latent variables—that is, it allows for determining how much each of the latent variables affects the outcome variable. To do this, SEM typically consists of four stages specifying the conceptual model of a system to be modeled in terms of potential causality and correlation):

(1) Defining nodes [8, 9] and variables that are used to measure them
(2) Defining relations between variables (correlation)
(3) Specifying the causal structure (chains)
(4) Defining the functional form and estimating model parameters

The causal structure of the model is defined as a set of causal formulas and links between different variables that define which relations hold between them. In our case, each formula is a differential equation that links SES functions with pressure. The partial differential equations are stochastic in nature (that is, they are random), which increases their flexibility to fit multiple systems. The differential equations can be solved by a variety of methods such as particle filtering techniques [10]. However, it is more efficient to use an evolutionary algorithm that can solve thousands of equations in parallel [11].

2.1. Literature Review. Sustainability can be defined as the ability of a system to sustain its structure and functions [12]. Therefore, sustainability demands that we "balance" the management of ecosystems and their SES functions. Balancing however requires that we acquire deep insights into interactions between all major factors driving the system.

In this section, we review some of the major factors that drive marine ecosystems and discuss how they influence SES functions.

2.1.1. Fishing Pressure. Fishing pressure is one of the major drivers that can have a profound impact on marine ecosystems. The results of fisheries research, in particular, suggest that overfishing and degraded ecosystem functions will continue to be major problems in the coming years [13].

However, fisheries are a very complex system. For example, fishing pressure can be direct or indirect and depends on legal frameworks related to anchoring or harvesting. Furthermore, it can have positive impacts on other functions such as ecotourism if managed properly. In order to properly evaluate the sustainability of marine economies we need to get better understanding of these underlying factors [14, 15] and their interactions.

2.1.2. Marine Tourism. The recreational fishing industry plays a major role in the national economy of most countries (Lincoln and Shackelford, 2005). In fact, recreational fishing is responsible for approximately $48 billion USD to the US economy alone every year. However, this activity is dependent on marine ecosystems and their key SES functions [16]. In order to regulate this sector of the economy, we need to understand how different parameters such as tourism activities affect ecosystem functions [17].

2.1.3. Trawling. Trawling is a particularly harmful form of fishing that has been devastating many marine ecosystems around the world [18]. The pressure exerted by trawling vessels is such that it can have a negative impact on key SES functions in some cases. However, together with other fishing methods, trawling can also be used as a management tool that can be used to maintain the health of certain SES functions [19]. Therefore, we need to understand which parameters drive the impacts of trawling.

2.2. Bottom-Up Effects. Bottom-up effects are also known as bottom-up pressures or heretofore undiscovered effects and are critical because they play an important role in driving the loss of ecosystems and their SES functions [20]. In a recent study, for example, it is shown that the loss of coral reefs can be driven by climate change and overfishing [21]. These complex interactions are difficult to detect as we rarely have complete information on different SES functions and their relationships.

The problem described above is potentially solvable if we use an integrative modeling approach that can combine many separate models into one framework. This framework can be used to address the following questions:

(1) How much of each of the SES functions will remain under different fishing scenarios (e.g., sustainable fisheries)?

(2) What are the critical points where ecosystem functions become unsustainable?

(3) What are the major drivers that have a strong influence on the structure of the ecosystem and its SES functions?

The goal of this kind of framework is to provide better management solutions by allowing us to make better decisions. Therefore, it is important that we understand how marine ecosystems and their SES functions work in order to achieve sustainability.

In order to obtain some insight into these complex interactions, we will use an integrated modeling method that combines multiscale modeling with evolutionary algorithms. In the process, we will use a simple but effective differential equation model which can be solved using particle filtering methods [22].

3. Method

Research is conducted with a descriptive approach of mixed methods (quantitative-qualitative). The data used is secondary data obtained from statistical sources and scientific literature reviews. Data processing is carried out using linear regression analysis of the ordinary least square (OLS) method in the data period of 2011–2020. The mathematical model formed is as follows:

$$Y = \beta_0 + \beta_1 . X_1 + \beta_2 . X_2 + \beta_3 . X_3 + \beta_4 . D + \varepsilon, \quad (1)$$

$$EG = C + \beta_1 . G\ DP + \beta_2 . TR + \beta_3 . G + \beta_4 . TA + \varepsilon, \quad (2)$$

where EG is the economic growth (in percent); GDP is the gross domestic product (in billions of rupiah); TR is the tax revenues (in billions of rupiah); G is the government expenditures (in billions of rupiah); TA is the dummy variable of tax amnesty policy, divided by a binary number: 0 for period before implementation (2011–2015) and 1 for period after implementation (2016–2021).

After regression analysis of the model estimation, the next is residual testing through 3 classical assumption tests, namely, normality, multicollinearity, and autocorrelation. Normality tests are performed to see the residual distribution conditions of the data. The normality test is carried out by the Jarque–Bera method. If the p value is less than α (0.05), it means that residual data is not normally distributed. Multicollinearity tests are conducted with the aim of knowing the correlation between independent variables. Testing is done with the pairwise method. If the correlation value is above 0.8, it means that there is a multicollinearity problem in residual data. The autocorrelation test is conducted with the aim of knowing the existence of variable correlations in the prediction model with changes in time. Testing is conducted through the BG serial LM test. If the Prob. F value is less than α (0.05), it means that there is autocorrelation problem in the prediction model. Model estimation should be free from the problem of testing classical assumptions. If there is a problem, it is necessary to make improvements to the model.

4. Result and Discussion

4.1. Descriptive Analysis. Data on tax revenue statistics in Indonesia shows that in the last ten years the trend of tax revenues has tended to rise. In 2011, the tax revenue rate was Rp 878.685,22 billion. Until 2016, the rate of tax revenue has always increased. Growth in tax receipts from 2012 to 2016 was 15,65%, 13%, 8,51%, 19,51%, and 3,35%. In the period 2011 to 2021, the highest tax revenue rate occurred in 2015, which amounted to Rp 243.148,53 billion. Tax revenues also decreased in 2017 and 2020. The largest tax decrease occurred in 2020, which amounted to Rp 381.871,15 billion or equivalent to 21,38% compared to the previous year. Overall, in the last 11 years, tax revenues in Indonesia rose by Rp 525.822,28 billion or equivalent to 59,84%. If viewed in the period before and after the implementation of tax amnesty volume 1 of president Joko Widodo's leadership, which is in 2016, the average tax revenue per year was Rp 1.564.171,55 billion, while before the tax amnesty volume 1, the average tax revenue per year was Rp 1.155.729,94 billion; therefore, after the tax amnesty volume 1, it can be concluded that the average tax revenue per year is greater than Rp 408.441,61 billion when compared to the period before enactment of tax amnesty volume 1 as shown in Table 1.

Almost the same as the trend of tax revenues, data on the gross domestic product (GDP) rate also has a trend that tends to rise in the last 11 years. The GDP data shown is the GDP spending approach based on constant price of 2010 base year. In 2011, Indonesia's GDP amounted to Rp 7.287.635,3 billion. The following year, GDP increased by Rp 439.448,1 billion. Overall, the largest GDP increase occurred in 2019, amounting to Rp 523.185,9 billion. But in the following year, GDP actually decreased quite sharply, amounting to Rp 226.595,1 billion. This happened because of the COVID-19 pandemic that made the activities of almost all sectors of economy difficult to run. Economic growth data that is a reflection of the increase in GDP automatically also has the same trend as GDP. The largest increase in economic growth occurred in 2016, which was 0,15 basis points compared to the previous year. As for the largest decline in economic growth occurred in 2020, which amounted to 7,09 basis points compared to 2019. The average economic growth per year after tax amnesty volume 1 is 3,64%. This figure is smaller than that before enactment of tax amnesty volume 1. This indicates a slowdown in economic growth in the last 5 years as shown in Table 2.

Government expenditures as one of the constituent components of GDP must also be analyzed for its development. The increase in government expenditures from 2011 to 2021 has a trend tending to rise. In 2011 government expenditure was at Rp 1.320.752,32 billion. Then, it increased by Rp 227.559,02 billion, equivalent to 17,23%, the following year. The largest increase in government expenditures occurred in 2012, while the smallest increase in government expenditures occurred in 2017, amounting to

Table 1: Tax revenue and gross domestic product of Indonesia on 2011–2021.

Year	Tax revenues (billions of rupiah)	GDP (billions of rupiah)
2011	878.685,22	7.287.635,30
2012	1.016.237,34	7.727.083,40
2013	1.148.364,68	8.156.497,80
2014	1.246.106,96	8.564.866,60
2015	1.489.255,49	8.982.517,10
2016	1.539.166,24	9.434.613,40
2017	1.472.709,86	9.912.928,10
2018	1.618.095,49	10.425.851,90
2019	1.786.378,65	10.949.037,80
2020	1.404.507,50	10.722.442,70
2021	1.444.500,30	11.118.868,50

Source: Indonesian Central Bureau of Statistics, 2022.

Table 2: Government expenditure and GDP growth of Indonesia in 2011–2021.

Year	Government expenditures (billions of rupiah)	GDP growth (%)
2011	1.320.751,32	6.17
2012	1.548.310,34	6.03
2013	1.726.191,30	5.56
2014	1.876.872,76	5.01
2015	1.984.149,71	4.88
2016	2.082.948,90	5.03
2017	2.133.295,92	5.07
2018	2.220.656,97	5.17
2019	2.461.112,04	5.02
2020	2.739.165,87	−2.07
2021	2.786.809,38	3.69

Source: Indonesian Central Bureau of Statistics, 2022.

Table 3: Output of multiple regression.

Variable	Coefficient	Std. error	*t* statistic	Prob.
C	2.475245	1.039703	2.380722	0.0037
LOG (GDP)	3.802031	1.418237	2.680815	0.0262
LOG (TR)	1.365366	0.338075	4.038644	0.0099
LOG (*G*)	2.520684	0.592713	4.252785	0.0081
TA	0.074447	0.032145	2.315960	0.0376
R-squared	0.932529			
F-statistic	17.27660			
Prob. (F-statistic)	0.003939			

Source: data processed, 2021.

Rp 50.347,02 billion or equivalent to 2,42% compared to the previous year. The average government expenditures before the enactment of tax amnesty volume 1 are Rp 1.691.255,09 billion per year. Meanwhile, since 2016, the average government expenditure has risen to Rp 2.327.435,94 billion per year. This can be interpreted by the fact that, in the last 5 years, the government has been more active in doing shopping. Overall, in the last 11 years, there has been an increase in government expenditures of Rp 1.418.414,55 billion or equivalent to 107,39% when compared to the figure in 2011.

4.2. Empirical Analysis. As shown in Table 3, from the results of the data processing using ordinary least square regression, all variables have been in order with the theory. From the results of the estimated output, the mathematical model can be written as follows:

$$EG = 2,47 + 3,80\,LOG(GDP) + 1,36\,LOG(TR) + 2,52\,LOG\,(G) + 0,07\,TA + \varepsilon. \quad (3)$$

Judging from the coefficient value, all independent variables have a positive effect on dependent variables. As a proof of the validity of empirical evidence, it has been tested on data, starting from residual testing through classical assumption tests and then testing data as proof of hypothesis and interpretation of coefficient of determination.

4.2.1. Classical Assumption Test. The normality test is performed to test the residual results of the model estimate. Three types of residual testing were done, namely, normality test, multicollinearity test, and autocorrelation test. This is done based on consideration of the data used. Normality test was conducted using the Jarque–Bera (JB) method. The resulting p value is at 0.5984. From these results, it can be concluded that the p value > 0.05. This means that residual data is normally distributed as shown in Figure 1.

Multicollinearity problem detection was done through pairwise correlation testing. Multicollinearity test results showed that the correlation coefficient of all variables was less than 0.8. This means that there is no multicollinearity problem in the model tested as shown in Table 4.

Next is the detection of autocorrelation problems done through LM test. From the test, we obtained the result that the value of Prob. F amounted to 0.5251. This means that Prob. F value > 0.05, so it can be concluded that there are no autocorrelation problems in the model as shown in Table 5.

4.2.2. Hypothesis Testing. Hypothesis testing is done with two approaches: partial and simultaneous. Partial tests are conducted through a comparison of t table and t statistics, while the simultaneous test is conducted through the comparison of F table value and F statistics value as shown in Table 6.

From the results of partial tests through comparisons of t tables and t statistics, all independent variables have a statistical t value greater than t tables, meaning that the variables gross domestic product, tax revenues, government expenditures, and tax amnesty each have a significant effect on the variable economic growth. Partial tests can also be performed by looking at the Prob. value of each variable. If the Prob. value < 0.05, it means that the variable has a significant influence as shown in Table 7.

Simultaneous hypothesis testing conducted through the comparison of F tables and statistical F shows that F statistics > F tables, meaning that simultaneously all independent variables have a significant effect on dependent variables.

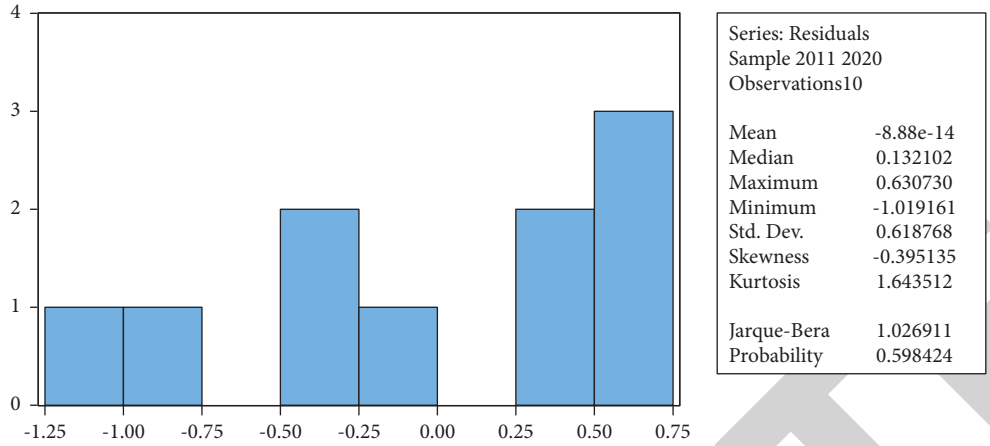

Figure 1: Output of normality test.

Table 4: Output of multicollinearity test.

	LOG (GDP)	LOG (TR)	LOG (G)	TA
LOG (GDP)	1.000000	0.516321	0.567335	0.576089
LOG (TR)	0.516321	1.000000	0.575004	0.548830
LOG (G)	0.567335	0.575004	1.000000	0.591450
TA	0.576089	0.548830	0.591450	1.000000

Source: data processed, 2021.

Table 5: Output of autocorrelation test.

Breusch–Godfrey serial correlation LM test			
F-statistic	0.804639	Prob. F (2, 3)	0.5251
Obs*R-squared	3.491389	Prob. Chi-Square (2)	0.1745

Source: data processed, 2021.

Table 6: Output of partial hypothesis testing.

Variable	Df	*t* table	Abs *t* stat	Result
LOG (GDP)	9	2,26	2,68	H_0 rejected, H_a accepted
LOG (TR)	9	2,26	4,03	H_0 rejected, H_a accepted
LOG (G)	9	2,26	4,25	H_0 rejected, H_a accepted
TA	9	2,26	2,31	H_0 rejected, H_a accepted

Source: data processed, 2021.

Table 7: Results of simultaneous hypothesis testing.

Variable	Df1	Df2	F table	Abs F stat	Result
All variables	5	4	6,26	17,27	H_0 rejected H_a accepted

Source: data processed, 2021.

4.2.3. Determination Coefficient. The regression results through ordinary least square show that the value of R-squared is 0.9325. This means that all independent variables are able to explain the state of independent variables by 93,25% as shown in Table 8.

4.3. Coefficient Interpretation. From the coefficient value of the data processing, we can see the magnitude of the influence of each variable. The constant coefficient is 2.47. This means that when all independent variables do not change, the economy will continue to experience growth of 2,47%. This is thought to occur because the presence of other variables (beyond the variables studied) affects the economic sector. The LOG (GDP) variable has a coefficient of 3.80 meaning that when GDP rises by 1%, the economy will grow by 3,8%. The tax revenues variable has a coefficient of 1.36. This means that when tax revenues rise by 1%, the economy will grow by 1,36%. Furthermore, the government

Table 8: Determination coefficient.

R-squared	0.932529	Mean dependent var	4.587000
Adjusted R-squared	0.878553	Std. dev. dependent var	2.382161

Source: data processed, 2021.

expenditures variable has a coefficient of 2.52. This means that when government spending rises by 1%, the economy will grow by 2,52%. Then, the dummy variable tax amnesty also shows a significant positive influence, which is at a coefficient of 0.07. This means that there is a difference in economic growth of 0,07% after the tax amnesty policy volume 1.

5. Discussion

In general, economic growth figures in Indonesia have been outlined in the "Descriptive Analysis." The value of economic growth discussed is economic growth in general. In the period 2011–2021, it is seen that the average economic growth before tax amnesty is actually slightly higher than that after tax amnesty volume 1. However, this cannot be fully attributed to the taxation aspect, considering that economic growth in Indonesia is influenced by many factors. In the current COVID-19 pandemic conditions, economic conditions in previous times will feel biased if used as a benchmark, considering the cause of the current recession is difficult to predict when it ends. The government's efforts to re-implement the tax amnesty policy to speed up economic recovery are a step worth considering. Compared to other countries, the implementation of the tax amnesty in Indonesia is arguably a success. The declared price value reached 39.5% of gross domestic product (GDP), far above countries such as India, Spain, or Italy which previously also implemented a tax amnesty. Meanwhile, the Rp 14.23 trillion ransom was equivalent to 1.08% of GDP at that time, higher than similar programs in Germany, Belgium, and Australia. Several efforts have been made to encourage economic growth and reduce poverty; one of them is achieved through increasing government spending. Government expenditure is part of fiscal policy, namely, an action by the government to regulate the course of the economy through budget. Government spending is needed to increase physical capital such as infrastructure basic and public facilities, as well as for the improvement of public services such as health, education, social protection, order and peace, and the environment, which in turn can improve the economy and social welfare. One of the targets of government spending is to increase production capacity and maintain sustainable growth economy. In realizing this goal, government spending is usually allocated to fixing infrastructure because all economic activities require adequate facilities and infrastructure. The effectiveness of government spending on development performance in Indonesia has been widely studied by researchers. Abdullah and Rusdarti's study (2017) reveals that government spending in developing countries such as Indonesia, Malaysia, Singapore, Ethiopia, Nigeria, and India and developed countries in Europe have positive influence on economic growth.

5.1. Projection of Re-implementation of Tax Amnesty Policy. The reintroduction of tax amnesty is a chance for taxpayers to reveal tax liabilities that have not been paid voluntarily by paying income tax based on asset disclosure. Many advantages will result from the adoption of this policy, including the removal of administrative punishments for taxpayers and data protection in the form of the revealed property data not being used as a basis for inquiry, investigation, or criminal prosecution of taxpayers.

If those advantages are linked to economic development, then the re-implementation of the tax amnesty is expected to boost economic growth. Starting with the rising number of assets raised, there will be a lot of ransom, which will result in a rise in tax revenues. The budgetary foundations of the government are strengthened by greater tax receipts. The government's ability to spend money is increasing. The economic environment will improve, resulting in more economic activity, lower unemployment, and higher economic growth. However, as stated in the "Introduction" and "Literature Review," adopting this policy necessitates a number of difficult considerations in order to fulfill the goals established.

5.2. Implication. The study's findings suggest that tax amnesty has been experimentally proved to boost economic development in a favorable manner. However, when compared to other factors, its impact on economic development seems to be the least. The government must evaluate the level of GDP and government expenditures if the goal is to boost economic growth. When considering a tax amnesty scheme, the state of political stability must also be taken into account. Furthermore, the procurement of tax amnesty does not have to avoid long-term length and frequency too often since it is believed that it would alter taxpayer behavior. This lends credence to Ibrahim's study (2017).

6. Conclusion

Because taxes are the primary source of governmental revenue, their movement is critical. The situation of economic circumstances that have slowed since 2018 is worth considering. Tax amnesty is an issue worth addressing in analyzing economic development, given the amount of studies that show it may enhance tax compliance while failing to fulfill tax revenue objectives. Taxes are components that impact a country's disposable income, which is expressed in the form of GDP. Government spending, which includes both central government spending and monies distributed to the area, is also a factor in determining the pace of economic growth, particularly when using the GDP spending method. The findings of time series data regressed OLS revealed that GDP, tax revenues, government expenditures, and tax amnesty all had a substantial influence on economic growth, partly and concurrently. The findings also revealed that the pace of economic development differed before and after the introduction of tax amnesty volume 1 in 2016. Tax amnesty is a good way to stimulate economic development, but it must take into consideration political

Hindawi
Journal of Environmental and Public Health
Volume 2023, Article ID 9871694, 1 page
https://doi.org/10.1155/2023/9871694

Retraction

Retracted: Research on Recurrence Plot Feature Quantization Method Based on Image Texture Analysis

Journal of Environmental and Public Health

Received 15 November 2022; Accepted 15 November 2022; Published 29 January 2023

Journal of Environmental and Public Health has retracted the article titled "Research on Recurrence Plot Feature Quantization Method Based on Image Texture Analysis" [1] due to concerns that the peer review process has been compromised.

Following an investigation conducted by the Hindawi Research Integrity team [2], significant concerns were identified with the peer reviewers assigned to this article; the investigation has concluded that the peer review process was compromised. We therefore can no longer trust the peer review process, and the article is being retracted with the agreement of the Chief Editor.

References

[1] Y. Li and Z. Li, "Research on Recurrence Plot Feature Quantization Method Based on Image Texture Analysis," *Journal of Environmental and Public Health*, vol. 2022, Article ID 2495024, 12 pages, 2022.

[2] L. Ferguson, "Advancing Research Integrity Collaboratively and with Vigour," 2022, https://www.hindawi.com/post/advancing-research-integrity-collaboratively-and-vigour/.

Hindawi
Journal of Environmental and Public Health
Volume 2022, Article ID 2495024, 12 pages
https://doi.org/10.1155/2022/2495024

Research Article

Research on Recurrence Plot Feature Quantization Method Based on Image Texture Analysis

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Received 11 May 2022; Revised 15 June 2022; Accepted 9 July 2022; Published 8 August 2022

Academic Editor: Sivakumar Pandian

The nonlinear time-series analysis method, based on the recurrence plot theory, has received great attention from researchers and has been successfully used in multiple fields. However, traditional recurrence plots that use Heaviside step functions to determine the recursive behavior of a point in the phase space have two problems: (1) Heaviside step functions produce a rigid boundary, resulting in information loss; and (2) the selection of the critical distance, ε, is crucial; if the selection is inappropriate, it will result in a low-dimensional dynamics error, and as of now, there exists no unified method for selecting this parameter. With regard to the problems described above, the novelty of this article lies in the following: (1) when determining the state-phase point recursiveness, a Gaussian function is used to replace the Heaviside function, thereby solving the rigidity and binary value problems of the recursive analysis results caused by the Heaviside step function; and (2) texture analysis is performed on a recurrence plot, new ways of studying complex system dynamics features are proposed, and a system of complex system dynamic-like measurement methods is built.

1. Introduction

Recurrence is one of the most basic qualities of a dynamic complex system. Some similar behaviors possess similar approaches to development. This type of state recurrence phenomenon is called recursive behavior and indicates that at different points in time, complex systems possess similar dynamic behavior. Although recursive behavior in the natural world received interest relatively early on, it was limited by the computing technology of that time. Furthermore, higher-dimensional complex systems lacked effective processing methods and computing technology. Eckmann et al. [1] constructed a recurrence plot theory that provides a highly operable method for phase-space reconstruction and the analysis of complex systems. The intrinsic ideology behind this method is to construct a phase space that is equal to the state of a primary dynamic system by reconstructing a phase space, reverting to a high-dimensional evolution state of a one-dimensional time series, and reconstituting the one-dimensional sequence into the trajectory of the point in the high-dimensional phase space. On this basis, the dynamic laws and features of the evolution of the primary dynamic system can be further analyzed. The traditional analysis of a time series is usually carried out in the frequency domain or time domain, while chaotic time series have nonlinear features and are difficult to model and calculate with traditional methods. Therefore, the analysis of chaotic time series is usually carried out in phase space. In recent years, the recurrence plot method has gradually developed into an effective tool for analyzing chaotic time series. The theoretical basis of the recurrence plot method is the time-delay embedding theory, which was proposed by Takens [2]. It is believed that as long as the embedding dimension is not less than twice the attractor dimension of the primary dynamic system, the reconstructed phase space and the phase space of the primary dynamic system will have topological equivalence. Therefore, a one-dimensional time series can be embedded into a topologically equivalent high-dimensional phase space through phase-space reconstruction, so that a trajectory of the state vector of the dynamic

system in the mathematical-phase space can be obtained. However, in the process of reconstructing the phase space, the embedding dimension and time delay are two important parameters. Although the delayed embedding theory has obtained good results in theory, in practical applications, this conclusion cannot be used to determine the embedding dimension. In practical applications, the false nearest neighbor method, constructed by Kantz [3], or the Cao algorithm [4–6], is used more often to calculate the embedding dimension of the system. For determining the time delay, τ, autocorrelation analysis is often used [7–10]. However, some scholars believe that the two parameters of embedding dimension and time delay are related, so they should be solved jointly. Kim et al. [11] were the first to try to comprehensively consider the joint determination method of the embedding dimension and delay time. Based on this idea, Tao et al. [12] further constructed a C-C method that uses a correlation integral to determine the values of the two parameters.

Marwan et al. [13] and Runqiang and Zhu [14] proposed that the recurrence plot method is a nonlinear analysis method for reconstructing the recursive behavior of complex dynamic systems, which allows the phase-space manifold of complex dynamic systems to be studied intuitively. Lv et al. [15] posited that the recurrence plot method is a nonlinear dynamic analysis method based on the phase-space reconstruction theory, which can reflect the laws of the chaotic attractor of the original system. Pham [16] constructed a fuzzy recurrence plot, and the reproduction of the phase-space state can be visualized as a grayscale texture, which enhances the ability to analyze information patterns. The fuzzy recurrence plot method replaces the critical similarity threshold required by the traditional recurrence plot. Sipers et al. [17] constructed multilevel recurrence plots (MRPs) and pointed out that MRPs with only a few discretization levels can usually capture the attributes and shapes of signals more accurately than traditional RPS. Tamura and Ichimura [18] constructed a recurrence plot based on a MACD histogram for time-series classification and representation. Riedl et al. [19] analyzed the characteristics and application fields of generalized recurrence plots. In general, the nonlinear time-series analysis methods based on the recurrence plot theory have received much attention from researchers in various fields, and they have been successfully applied to many fields, such as geology [20–23], ecology and biology [24–26], neuroscience [27–31], economic dynamics [32–34], industrial manufacturing, mechanical damage, and monitoring [25, 35–40], medicine [41–44], image processing, and audio and video analysis [45–47]anda CNN-based magnetic fingerprinting system using recurrence plots (RPs) was proposed as sequence fingerprints. Ref. [48] investigated the state transitions in different brain regions locally using a univariate measure based on dynamical system analysis named the recurrence plot (RP).

In the traditional recurrence plot method, with regard to how to judge whether the phase point of the two states in the phase space is recursive, the selection of the critical distance, ε, is important, but it is also a difficult task. Selecting inappropriate parameters will cause the low-dimensionality dynamic error. However, there is no uniform method for selecting this parameter at present, so it is usually necessary for the researcher to select an appropriate method according to the actual situation to determine it. If the ε selected is too small, there may be no or few recursion points in the recurrence plot, resulting in the inability to observe the recursive features of the system; but if the ε selected is too large, it may appear that almost every point has recursive behavior with neighboring points, which will cause thick and long diagonal lines in the recurrence plot. The general principle is that ε should not exceed 10% of the standard deviation of the time series [22, 49]. In many scholars' studies of specific problems, the more common approach has been to set the threshold to a certain proportion of the variance or standard deviation of the time-series data to be analyzed. Zhong et al. [50] used the recurrence plot method to study EHG signals, and the threshold was selected to be 0.5 to 1 time the standard deviation of the EHG sequence. When Chen et al. [51] studied the HRY signal, the threshold was selected to be 12% of the standard deviation of the original sequence data. In the study of protein structure prediction by Yang et al. [52], the rule for determining the threshold was to observe the change in the recursion rate. When the recursive rate changes for the first time, the corresponding threshold is the one that is sought. In general, the selection of ε does not form a unified method. The determination method is closely related to the specific problem to be studied and has a certain degree of experience. This is also a major problem when using the recurrence plot method. For different research objects, there are usually large differences in the criteria for selecting ε, but there is a slight difference in the selection of ε, and the obtained recurrence plots will have large differences, which poses greater challenges to the stability and reliability of the research results. Especially when constructing a recurrence plot through phase-space reconstruction, the Heaviside step function is usually used to judge the recursive behavior of the phase point of the state. When the distance between the phase points of the two states in the phase space is less than ε, we think of these two states as appearing recursive and vice versa; these two states do not appear to have recursive behavior. These processing methods have two problems as follows. (1) The research results have a strong dependence on the selection of the critical distance ε, but currently, there is no universal method for the selection of ε. This is also a difficult problem that we currency face in the research of nonlinear time series using phase-space reconstruction and recurrence plot methods. (2) The Heaviside step function has a rigid boundary problem, which will cause the loss of the original complex system dynamic behavior information contained in the nonlinear time series. When a phase point of a state is exactly outside the hypersphere with a certain phase point as the center and ε as the radius, the two state-phase points are considered completely dissimilar, and the phase points of the states distributed in the hypersphere are considered to be completely similar, but the differences between the phase points of these states are ignored. The innovation of this article is as follows: the use of the Heaviside step function will cause the recursive analysis

results to be rigid and binary, making the research results unreliable and thus increasing the difficulty of selecting ε. A slight change in ε or a change in the length and position of the time series will cause significant change to the results. In order to overcome the rigid boundary problem caused by the Heaviside step function, this article proposes using the Gaussian function instead of the Heaviside function when judging the recursiveness of the state-phase point. The Gaussian function can more accurately measure the recursive features of the two state-phase points in the reconstructed high-dimensional space. At the same time, as the Gaussian function has no rigid boundary, the recursiveness between all of the state-phase points in the reconstructed phase space can be determined by the state-phase distance between the points and the Gaussian function value. When the distance between the phase points of the state is 0, the degree of recursion between the phase points is 1; when the distance between the phase points of the state increases from zero to infinity, the degree of recursion between the phase points gradually changes from 1 to 0.

2. Gaussian Function Recurrence Plot and Texture Features' Analysis

2.1. Gaussian Function Recurrence Plot. According to the time-delay embedding theorem, the phase-space reconstruction method can be used for the one-dimensional time series $\{x_i \mid i = 1, 2, \ldots, n\}$. By selecting the appropriate phase-space dimension, m, and the delay time, τ, the one-dimensional time series can be reconstructed into an m-dimensional phase space, at which point a state vector set, $R^m = \left\{\overrightarrow{X_i}\right\}$, can be obtained, where $\overrightarrow{X_i} = (x_i, x_{i+\tau}, \ldots, x_{i+(m-1)\tau})$, $i = 1, 2, \ldots, n^*$ and $n^* = n - (m-1)\tau$. The vector set $\left\{\overrightarrow{X_i} \mid i = 1, 2, \ldots, n^*\right\}$ can be used to represent the state trajectory of a one-dimensional time series, $\{x_i \mid i = 1, 2, \ldots, n\}$, in a high-dimensional phase space. When the distance between the two state vectors in the phase space is less than ε, it can be considered that the two states exhibit recursive behavior of state recurrence. $R_{ij} = \Theta(\varepsilon - \overrightarrow{X_i} - \overrightarrow{X_j})$, $\overrightarrow{X_i}, \overrightarrow{X_j} \in R^m$, $i, j \in (1, 2, \ldots, n^*)$ and $\Theta(\bullet)$ are Heaviside functions, and the values of $\Theta(x) = \begin{cases} 1, x \geq 0 \\ 0, x < 0 \end{cases}$ and R_{ij} represent the recursive relationship between the state vectors $\overrightarrow{X_i}$ and $\overrightarrow{X_j}$ in the phase space. All of the R_{ij} will form a matrix R of 0 s and 1 s, which is called a recursive matrix. The recursive matrix can be represented by a two-dimensional graph. The value "1" is represented by a black dot, which means that the state of the system at time i is reproduced at time j; the value "0" is represented by a white dot, which means that the state of the system at time i is not reproduced at time j. The recurrence plot can be obtained from the recurrence relationship between the state vectors at each point in time of the system. In addition to the embedding dimension and time delay, the selection of ε is also important. If different ε values are selected, different recursive graphs may be obtained. However, there is currently no universal method for selecting ε. At the same time, Heaviside step functions have a rigid boundary problem, which will cause the loss of the originally complex system information contained in the nonlinear time series. This article uses a Gaussian function instead of Heaviside step function, as Gaussian functions can take continuous values, and there is no rigidity problem; at the same time, the obtained Gaussian function value is expressed in different grayscale levels, from small to large. The state recursive features of the complex system in the phase space will show different texture features in the recurrence plot. By studying these texture features, the similarity, mutation, and dynamic evolution of the dynamic features of the complex system can be identified:

$$R_{ij} = e^{-\sum_{k=1}^{m} \left| X_{ik} - Y_{jk} \right| / s * \tau}, \tag{1}$$

where s is the standard deviation of the time series $\{x_i \mid i = 1, 2, \ldots, n\}$, m is the embedding dimension, and τ is the time delay. When the state vectors $\overrightarrow{X_i}$ and $\overrightarrow{X_j}$ get close, R_{ij} approaches 1, and when the state vectors $\overrightarrow{X_i}$ and $\overrightarrow{X_j}$ grow further apart, R_{ij} approaches 0. In this way, a recursive matrix composed of numbers between 0 and 1 can be obtained. The larger the value of R_{ij}, the darker the color, and vice versa. The sine signal $\sin(6 * \pi * t)$ is constructed below, the sampling frequency is 1000 Hz, and 2000 data points are collected. The Lorentz signal has $\sigma = 10$, $b = 8/3$, $r = 28$, and the initial values of the three quantities are the time series generated by the $x(t)$ component in the case of (12, 2, 9), the traditional recurrence plot, and the Gaussian function recurrence plot of a random time series [see Figure1].

2.2. Recurrence Plot Texture Feature Similarity Analysis

2.2.1. Texture Feature Extraction. The local binary pattern (LBP), proposed by Ojala et al. [53], is an operator used to extract local texture features of an image. It has significant advantages such as rotation invariance and grayscale invariance. The basic idea of the LBP algorithm is as follows: in a $3 * 3$ window, take the grayscale value of the central pixel of the window as a threshold and compare the grayscale value of the pixels of the adjacent 8 points with it. If the central pixel value is less than the surrounding pixel value, the position of the surrounding pixel is marked as 0; otherwise, it is 1. Using 8 points in the $3 * 3$ neighborhood with this operation, you can obtain an 8-bit binary number (usually converted to a decimal number; that is, in the LBP code, there are 256 types). In this way, the LBP value of the center pixel of the window can be obtained. Then, this value is used to reflect the texture features in this area. The basic operation is shown in Figure 2.

The formula to calculate the LBP code is

$$\mathrm{LBP}(x_c, y_c) = \sum_{n=0}^{p-1} 2^n \Theta(i_n - i_c), \tag{2}$$

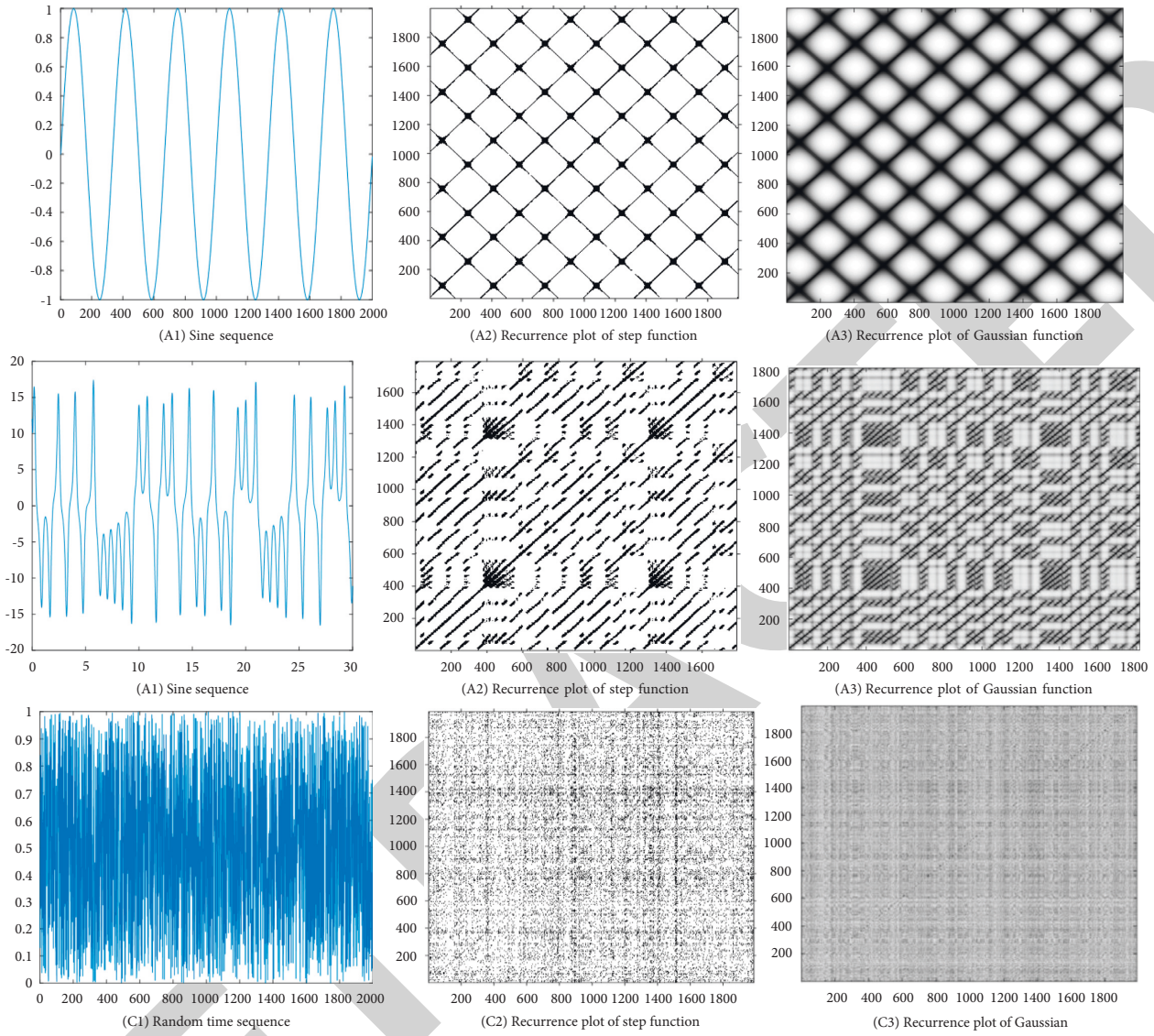


Figure 1: Traditional recurrence plot and recurrence plot of Gaussian function.

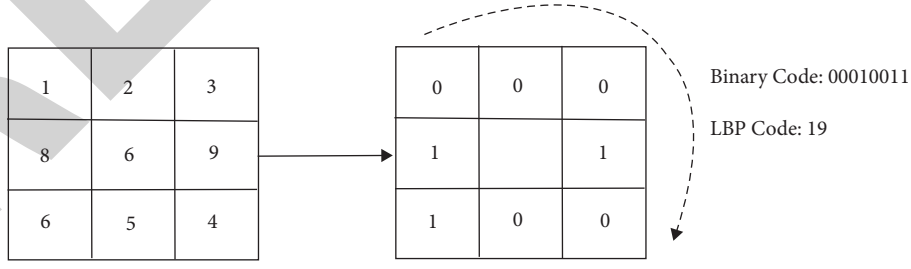


Figure 2: LBP code calculation.

where (x_c, y_c) is the center pixel; i_c is the grayscale value of the center pixel; i_n is the grayscale value of the neighboring pixels; and $\Theta(\bullet)$ is the Heaviside function, where $\Theta(x) = \begin{cases} 1, x \geq 0 \\ 0, x < 0 \end{cases}$.

Using the LBP operator, an LBP "code" can be proposed for each pixel, and the normalized statistical histogram from the LBP code can reflect the texture feature information of the image. It can be seen from Figure 3 that the statistical histograms of the LBP code of the periodic time series, the chaotic time series, and the random time series are significantly different from each other, thus indicating that the systems that generate these time series have different dynamic behavior features. This shows that the statistical

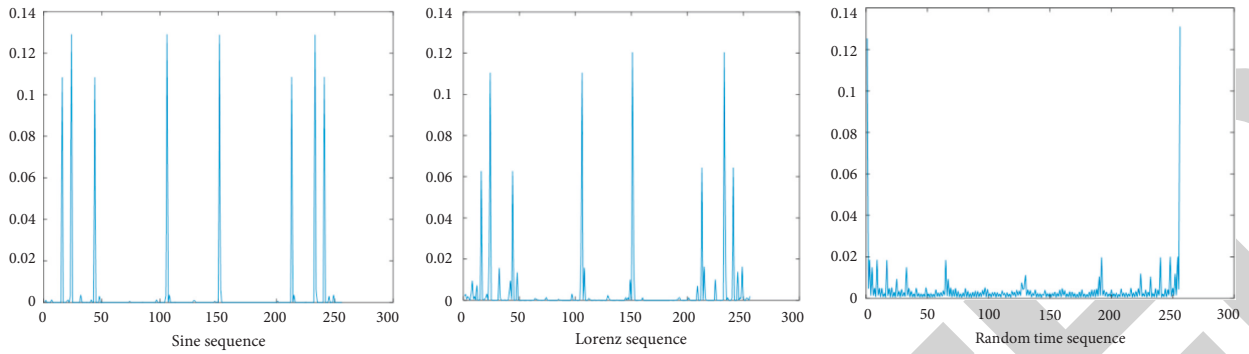


Figure 3: LBP coding statistical histogram. (a) Sine sequence, (b) Lorenz sequence, and (c) random time sequence.

histogram of the LBP code can reflect the difference between the dynamic features of the complex system.

One of the shortcomings of the LBP coding statistical histogram is that the overall LBP coding is statistically analyzed. The distinguishing effect is not ideal in some cases. At this time, we can introduce the method of image block processing, which divides the image into several sub-blocks. For example, we can decompose the overall recurrence plot into $m * n$ subregions and perform LBP processing on this small $m \times n$ region separately. This can greatly enhance the analysis effect of the dynamic features of the complex system.

2.2.2. Texture Feature Similarity Measure. Rubner et al. [54] constructed a method for measuring the similarity of image textures: Earth mover's distance (EMD). The basic idea of EMD is to precisely convert one type of distribution to the minimum cost that must be paid for another distribution. At first, the concept of EMD was mainly used for image retrieval work, and then, it was gradually used to measure similarity in other aspects. The EMD distance is actually the following linear programming problem. Suppose $P = \{(p_1, w_{p1}), (p_2, w_{p2}), \ldots, (p_m, w_{pm})\}$, where p_i represents a feature of an image, and w_{pi} represents the weight of the feature p_i, $Q = \{(q, w_{q1}), (q, w_{q2}), \ldots, (q, w_{qn})\}$, where q_j represents a feature of another image, and w_{pi} represents the weight of the feature q_j. $D = [d_{ij}]$ represents the distance matrix of the difference between the feature p set and the feature q set, where d_{ij} represents the distance of features p_i and q_j. Solve the matrix $F = [f_{ij}]$, where f_{ij} represents the amount of change from feature p_i to feature q_j, and d_{ij} represents the cost (distance) of features p_i and q_j. The goal is to minimize the global cost function:

$$\mathrm{WORK}(P, Q, F) = \sum_{i=1}^{m} \sum_{j=1}^{n} f_{ij} d_{ij}. \tag{3}$$

The following constraints must be met:

$$\begin{aligned} f_{ij} &\geq 01 \leq i \leq m, 1 \leq j \leq n, \\ \sum_{i=1}^{n} f_{ij} &\leq w_{pi} 1 \leq i \leq m, \\ \sum_{i=1}^{m} f_{ij} &\leq w_{pj} 1 \leq j \leq n, \\ \sum_{i=1}^{m} \sum_{j=1}^{n} f_{ij} &= \min\left(\sum_{i=1}^{m} w_{pi}, \sum_{j=1}^{n} w_{qj} \right). \end{aligned} \tag{4}$$

The first constraint indicates the change from P to Q; this cannot be reversed. The second constraint indicates that the total sum out of the amount of p_i cannot exceed the total amount w_{pi} of features p_i. The third constraint indicates that the inflow of q_j cannot exceed the amount it can accommodate w_{qj}. The fourth constraint indicates that the total amount of flow cannot exceed the total amount in P and the total amount that Q can accept. By solving this linear programming problem, we can get the optimal flow, F. To ensure that EMD does not change with the total flow, we can divide each flow by the total flow and normalize it. The distance between P and Q is

$$\mathrm{EMD}(P, Q) = \frac{\sum_{i=1}^{m} \sum_{j=1}^{n} f_{ij} d_{ij}}{\sum_{i=1}^{m} \sum_{j=1}^{n} f_{ij}}. \tag{5}$$

3. Value Analysis

Logistic mapping is a simple one-dimensional dynamic system with extremely complex behavioral characteristics. It originated from the population model in ecology. The mapping can produce aperiodic and nonconvergent sequences. The difference equation for generating the logistic sequence is $X_{n+1} = a * X_n(1 - X_n)$. *R.* May, a mathematical ecologist, published a classic paper in the journal Nature in 1976, and pointed out that when the parameter a changed

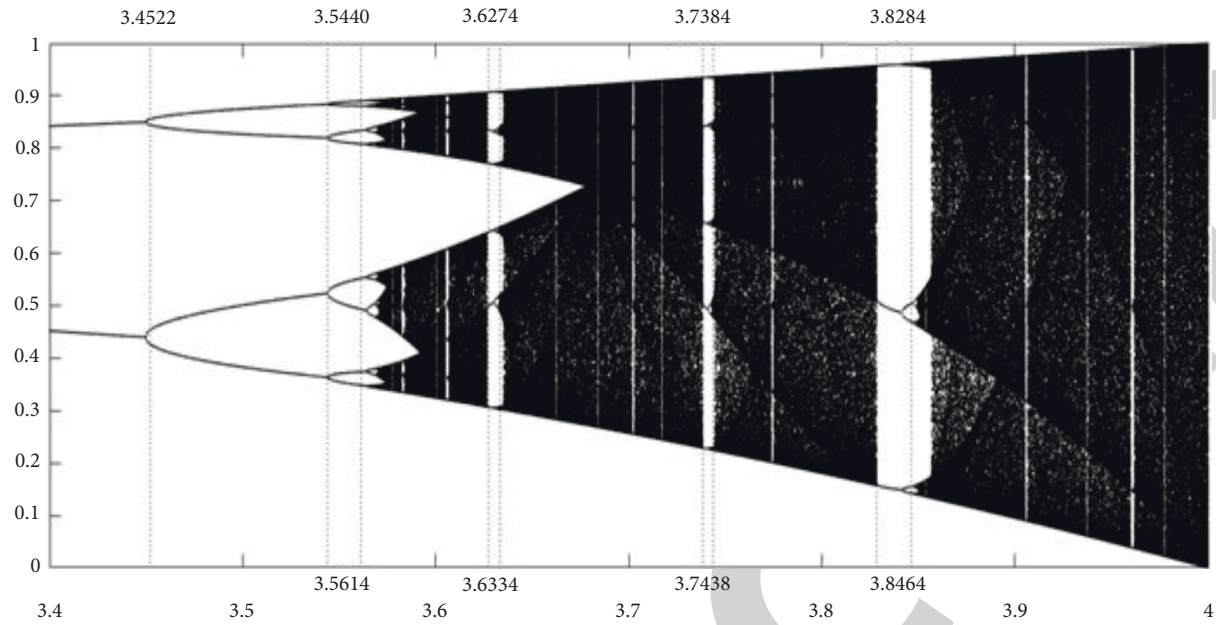


Figure 4: Logistic mapping sequence diagram.

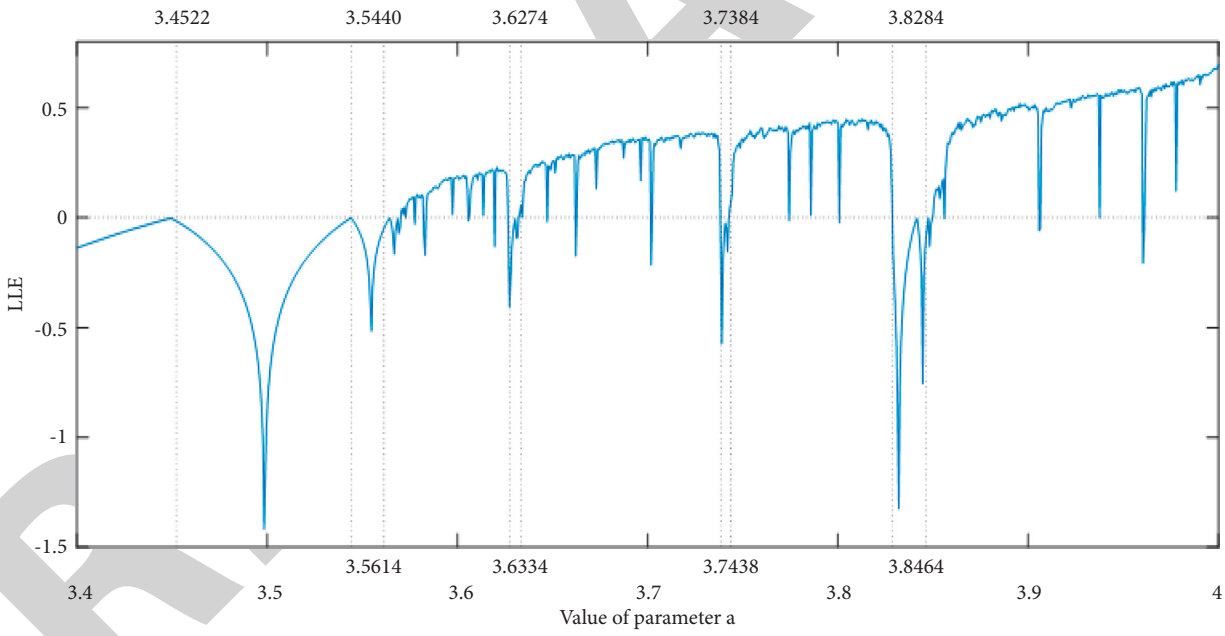
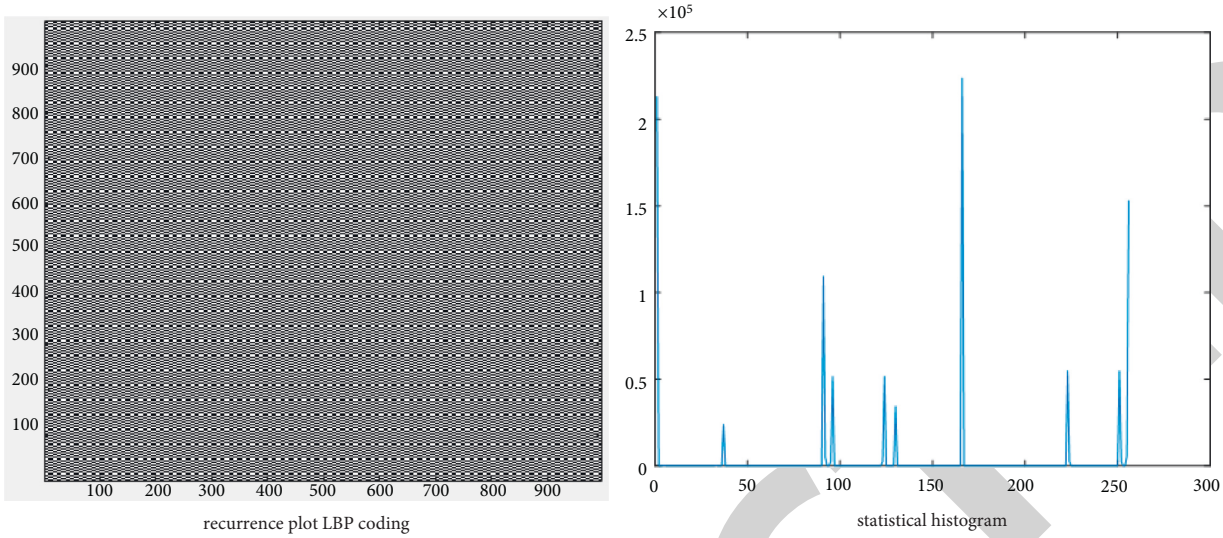
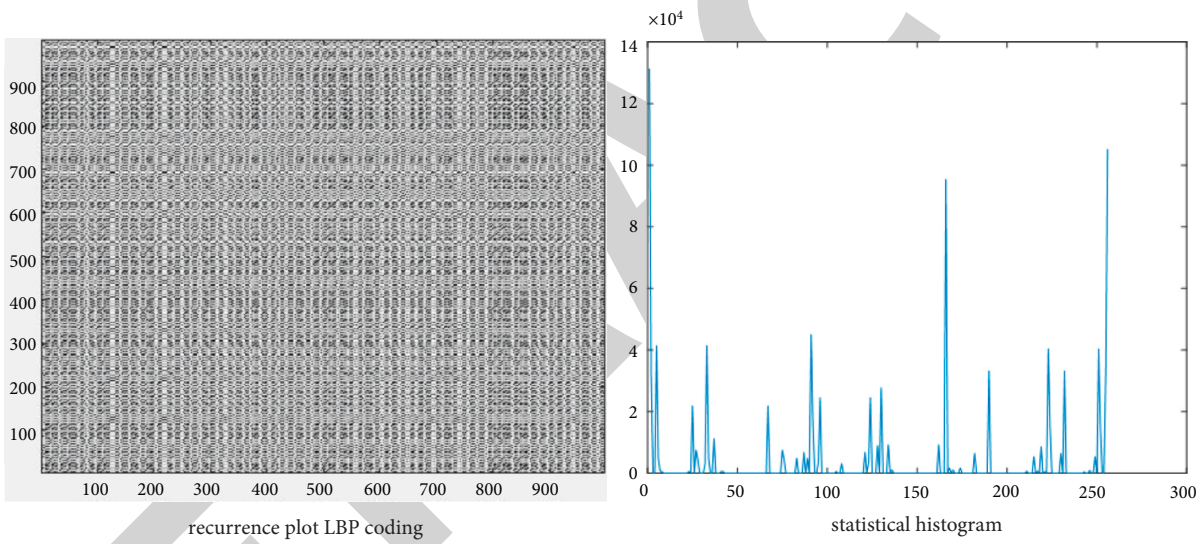


Figure 5: Graph of the largest Lyapunov exponent.

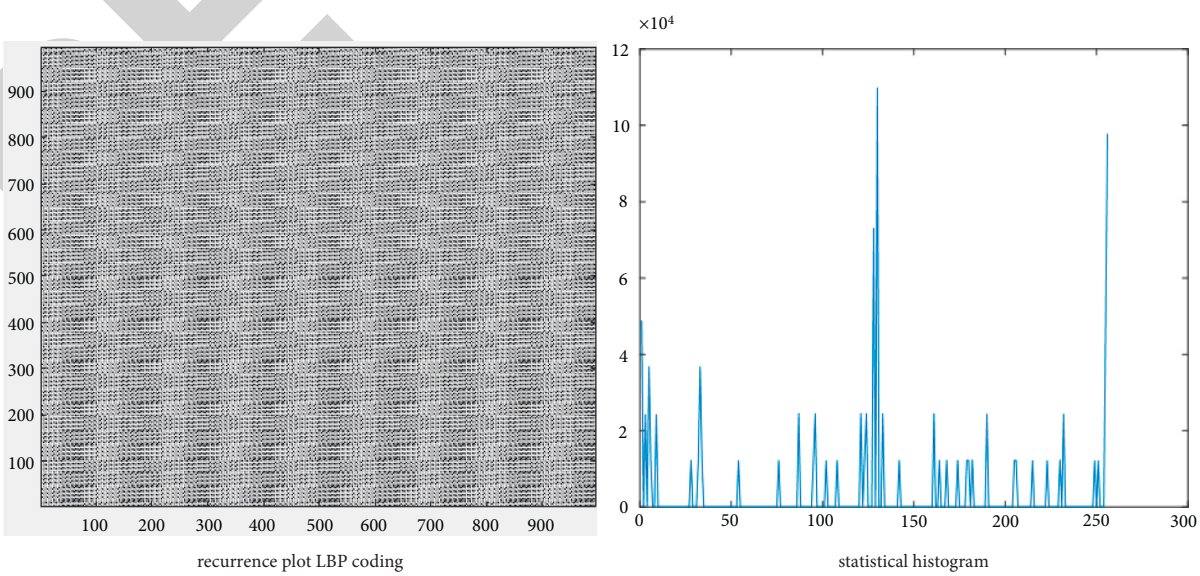
within the interval [3.5, 4], the logistic map exhibited a period-doubling bifurcation leading to chaos. Later, after further research by Feigenbaum, it was concluded that if a system has a period-doubling bifurcation, it will inevitably lead to chaos. When the parameter a was closer to 4, the logistic sequence X was closer to the average distribution for all of 0 to 1. When a changed from 3.4 to 4.0, the step size was 0.0006, the initial value $X_0 = 0.512$, and 2000 iterations were performed on each parameter value. After removing the first 1000 transient points, 1001 sequences could be obtained, and the graph xa was drawn, as shown in Figure 4. In Figure 4, at several vertical dotted lines (with parameter a as 3.4522, 3.5440, 3.5614, 3.6274, 3.6334, 3.7384, 3.7438, 3.8284, and 3.8464), the dynamic feature of logistic mapping exhibits substantial changes, and their performance in 10 different dynamic features regions is listed in the following order: 2 periods, 4 periods, 8 periods, chaos, 6 periods, chaos, 5 periods, chaos, 3 periods, and chaos. In order to further analyze the changes in the dynamic features of the logistic mapping on the corresponding parameter points, the following formula $\lambda = (1/N)\sum_{n=1}^{N} \log_2$ was used to calculate the maximum Lyapunov exponent of the sequence obtained



(a)

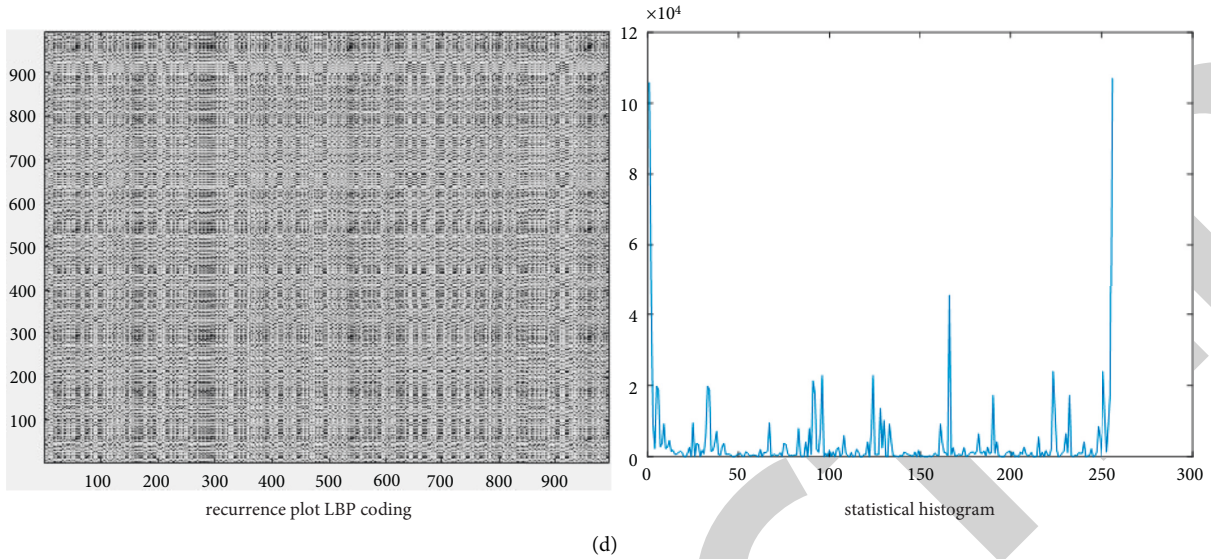


(b)

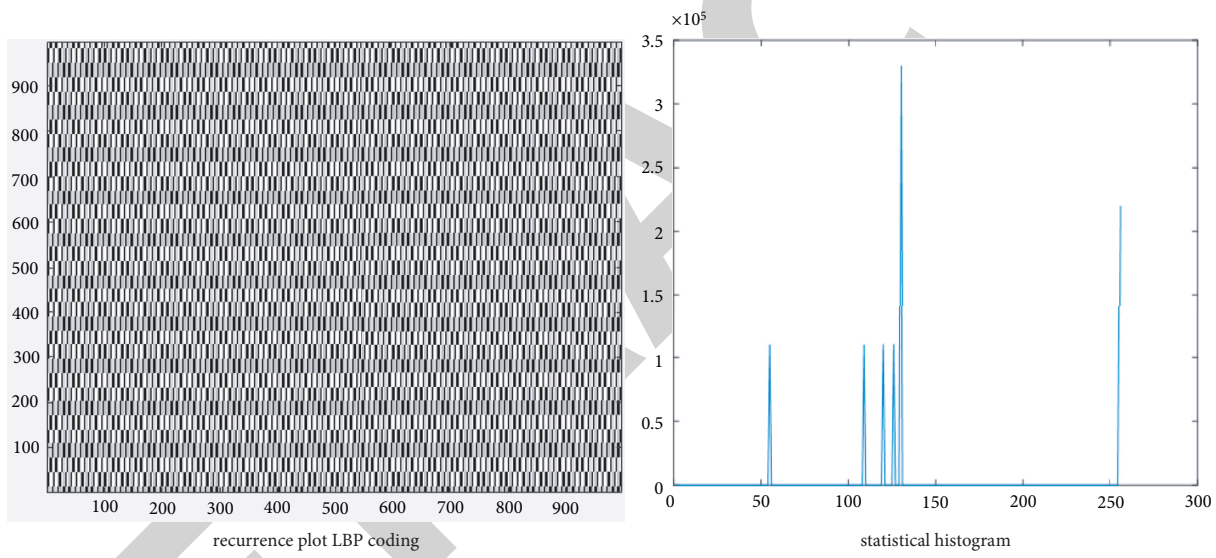


(c)

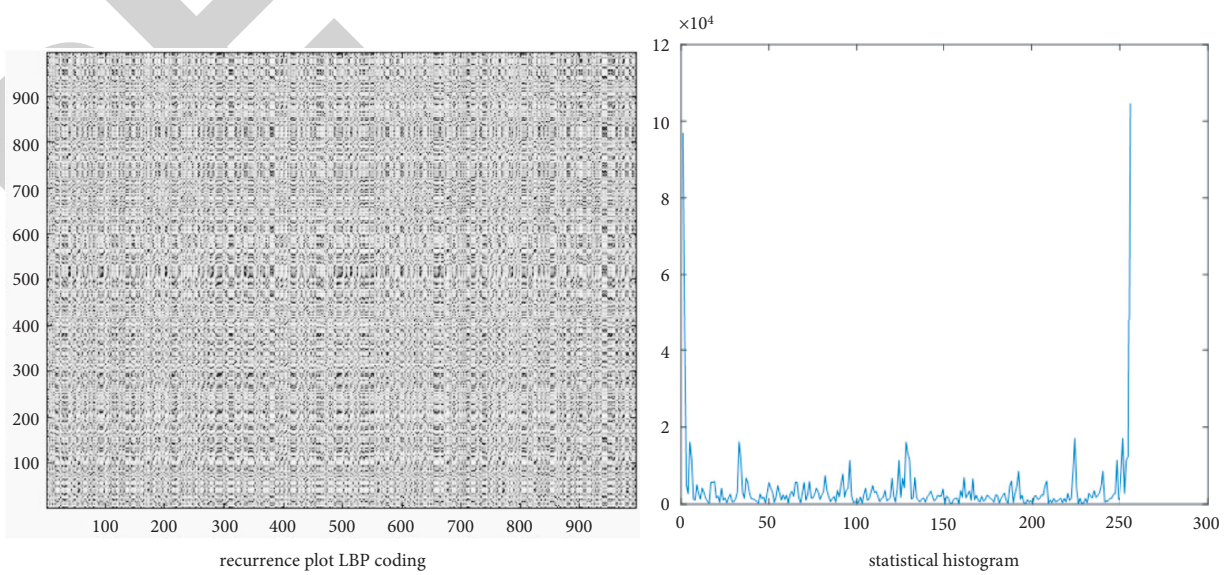
Figure 6: Continued.



(d)



(e)



(f)

Figure 6: Gaussian recurrence plot and LBP coding statistical histogram Gaussian. (a) Parameter $a = 3.4438$, (b) parameter $a = 3.6730$, (c) parameter $a = 3.7168$, (d) parameter $a = 3.7162$, (e) parameter $a = 3.8296$, and (f) parameter $a = 3.9454$.

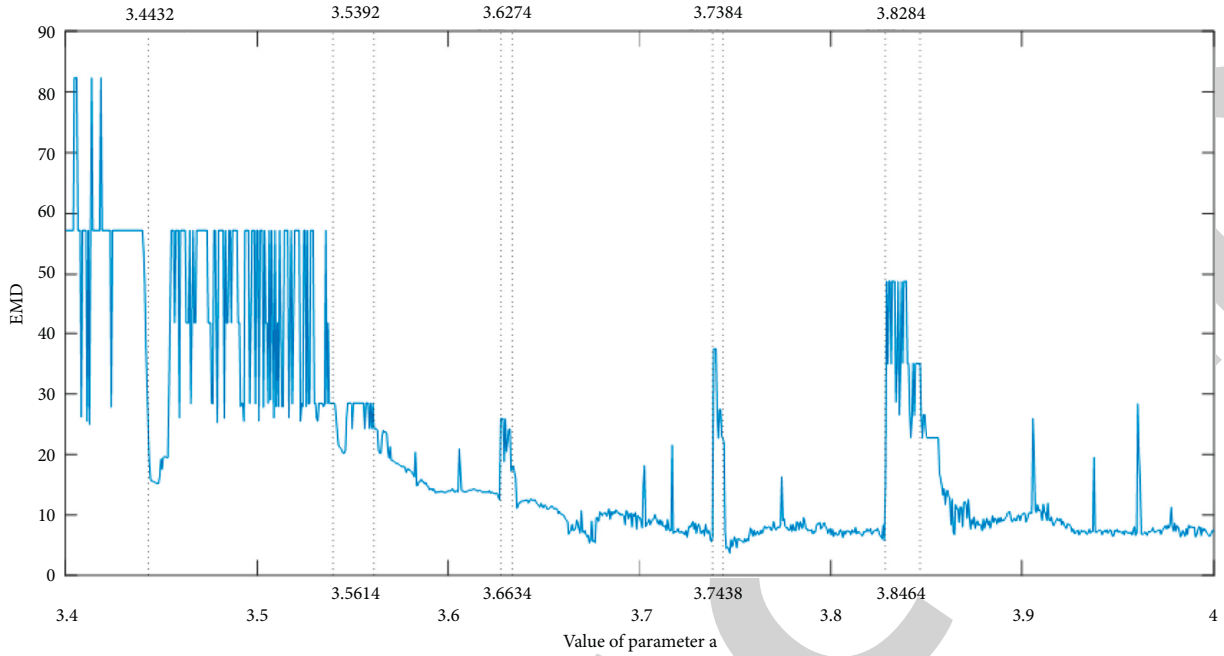


Figure 7: Similarity between system dynamics features and stochastic system dynamics characteristics under various parameters.

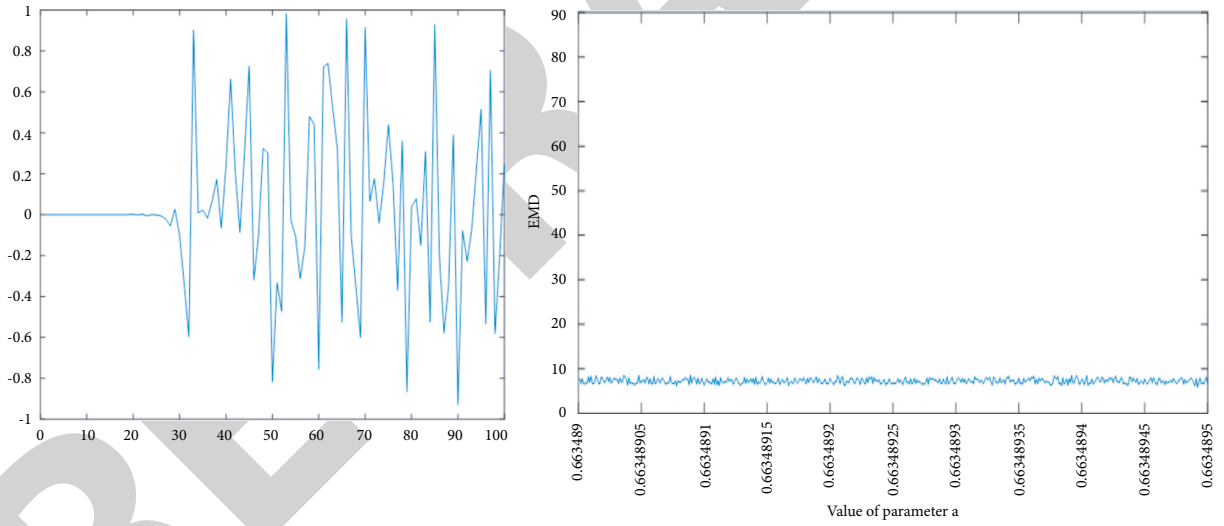


Figure 8: Parameter $a = 3.99$, similarity of dynamic features under different initial values.

by the logistic mapping at each parameter point. The maximum Lyapunov exponent varies with the parameter a, as shown in Figure 5. When the Lyapunov exponent is less than 0, the region is a periodic region of logistic mapping, and if the reverse is true, the corresponding sequence is a chaotic sequence. It can be seen from Figure 5 that at the corresponding bifurcation point, the Lyapunov index exhibits a significant change.

When the Gaussian recurrence plot and its texture analysis method constructed in this article were used, it can be seen from Figure 6 that the Gaussian recurrence plot has clear texture differences at different parameter values, and the LBP coding statistical histogram also has significant differences.

Next, the method of measuring the similarity of the dynamic features of two complex systems constructed in the second part of this article was used to analyze the changes in the dynamic features of 1001 sequences obtained after removing the first 1000 transient points when parameter a changed from 3.4 to 4.0, with a step size of 0.0006 and

X_0 = 0.512, and each parameter value was subjected to 2000 iterations. A random sequence was used as a benchmark for comparison, and the similarity between each sequence and the random sequence is measured. The result is shown in Figure 7.

When the parameter a is close to 4, after the parameter value a is determined, the initial value X_0 has an impact on the time-series value generated by the entire system. The entire system exhibits chaotic phenomena, and even when the initial value changes little, the time series values obtained by the system show large differences. When the parameter a = 3.99, the initial values are X_0 = 0.663489000 and X_0 = 0.663489001. At the beginning of the iteration, the difference between the two is small, approximately close 0, but as the number of iterations increases, the difference between the two sequences shows an irregularity. The magnitude of the change suddenly increases, so it can be seen that the system has a good avalanche effect, as shown in Figure 8(a). When we selected parameter a = 3.99, the initial value changed from 0.663489001 to 0.663489500, a total of 500 initial values were obtained, 2000 iterations were performed on each initial value, the first 1000 transient points were removed, and 500 time series were obtained. A random sequence was used as a benchmark for comparison to measure the similarity of dynamic features between each sequence and random sequence. The results are shown in Figure 8(b). Obviously, these sequences have the same dynamic feature similarity as random sequences.

4. Conclusion

In recent years, the recurrence plot method has gradually developed into an effective tool for analyzing chaotic time series. However, the traditional recurrence plot method uses the Heaviside step function to judge the recursive behavior of the state points in the phase space. The disadvantages of this processing method are that the results of the recursive analysis have rigidity and binary value problems. In order to overcome the rigid boundary problem caused by the Heaviside step function, this article proposes using the Gaussian function to replace the Heaviside function when judging the recursiveness of the state-phase point. At the same time, it puts forward the idea of texture analysis of recurrence plots with respect to the feature analysis of recurrence plots. On this basis, a method to measure the similarity of dynamic features of complex systems is constructed. Finally, a numerical analysis of the logistic system showed that the method constructed in this article could adequately describe the dynamic features of complex systems and measure the similarity of dynamic features between different complex systems. The method constructed in this article can provide an effective method for the feature extraction of complex system dynamics.

Data Availability

No data were used to support this study.

Conflicts of Interest

The authors declare that there are no conflicts of interest regarding the publication of this article.

Acknowledgments

This was supported by the Scientific Research Project of the Hunan Provincial Department of Education (Project no. 21B0701).

References

[1] J. P. Eckmann, S. O. Kamphorst, and D. Ruelle, "Recurrence plots of dynamical systems," *Europhysics Letters*, vol. 4, no. 9, pp. 973–977, 1987.

[2] F. Takens, "Detecting strange attractors in turbulence," *Lecture Notes in Mathematics*, Springer, Berlin, Germany, 1981.

[3] H. Kantz and T. Schreiber, *Nonlinear Time Series Analysis*, Cambridge University Press, Cambridge, UK, 1997.

[4] M. B. Kennel, R. Brown, and H. D. I. Abarbanel, "Determining embedding dimension for phase-space reconstruction using a geometrical construction," *Physical Review A*, vol. 45, no. 6, pp. 3403–3411, 1992.

[5] Y. Li, Y. Song, and C. Li, "Selection of parameters for phase space reconstruction of chaotic time series," in *Proceedings of the IEEE 5h International Conference on Bio-Inspired Computing: Theories and Applications (BIC-TA)*, pp. 30–33, Changsha, China, September 2010.

[6] L. Mesin and P. Costa, "Prognostic value of EEG indexes for the glasgow outcome scale of comatose patients in the acute phase," *Journal of Clinical Monitoring and Computing*, vol. 28, no. 4, pp. 377–385, 2014.

[7] A. M. Fraser and H. L. Swinney, "Independent coordinates for strange attractors from mutual information," *Physical Review A*, vol. 33, no. 2, pp. 1134–1140, 1986.

[8] R. Bramon, I. Boada, A. Bardera et al., "Multimodal data fusion based on mutual information," *IEEE Transactions on Visualization and Computer Graphics*, vol. 18, no. 9, pp. 1574–1587, 2012.

[9] Z. Zhang, Y. Fan, and H. Li, "A new algorithm for delay time selection in phase space reconstruction," *Journal of Computational Physics*, vol. 28, no. 3, pp. 469–474, 2011.

[10] K. S. Van Schooten, S. M. Rispens, M. Pijnappels, A. Daffertshofer, and J. H. Van Dieen, "Assessing gait stability: the influence of state space reconstruction on inter- and intra-day reliability of local dynamic stability during over-ground walking," *Journal of Biomechanics*, vol. 46, no. 1, pp. 137–141, 2013.

[11] H. S. Kim, R. Eykholt, and J. D. Salas, "Nonlinear dynamics, delay times, and embedding windows," *Physica D: Nonlinear Phenomena*, vol. 127, no. 1-2, pp. 48–60, 1999.

[12] H. Tao, X. Ma, and M. Qiao, "Determining parameters in the phase-space reconstruction of multivariate time series on genetic algorithm," in *Proceedings of the IEEE Intelligence Science and Information Engineering*, pp. 81–84, Wuhan, China, August 2011.

[13] N. Marwan, M. Thiel, and N. R. Nowaczyk, "Cross recurrence plot based synchronization of time series," *Nonlinear Processes in Geophysics*, vol. 9, no. 3/4, pp. 325–331, 2002.

[14] R. runqiang and Y. Zhu, "Speech endpoint detection method based on signal recursion analysis," *Journal of Communication*, vol. 28, no. 1, pp. 35–39, 2007.

[15] Y. Lv, J. Xu, and Y. Li, "Application of recursive graph and approximate entropy in complexity analysis of equipment fault signal," *Mechanical strength*, vol. 28, no. 3, pp. 317–321, 2006.

[16] T. D. Pham, "Fuzzy recurrence plots," *EPL*, vol. 116, no. 5, Article ID 50008, 2016.

[17] A. Sipers, P. Borm, and R. Peeters, "Robust reconstruction of a signal from its unthresholded recurrence plot subject to disturbances," *Physics Letters A*, vol. 381, no. 6, pp. 604–615, 2017.

[18] K. Tamura and T. Ichimura, "MACD-histogram-based recurrence plot: a new representation for time series classification," in *Proceedings of the IEEE International Workshop on Computational Intelligence & Applications*, no. 11, pp. 135–140, Hiroshima. Japan, November 2017.

[19] M. Riedl, N. Marwan, and J. Kurths, "Extended generalized recurrence plot quantification of complex circular patterns," *The European Physical Journal B*, vol. 90, no. 3, p. 58, 2017.

[20] B. Saussol, S. Troubetzkoy, and S. Vaienti, "Recurrence and lyapunov exponents," *Moscow Mathematical Journal*, vol. 3, no. 1, pp. 189–203, 2003.

[21] N. Marwan, M. H. Trauth, M. Vuille, and J. Kurths, "Comparing modern and Pleistocene ENSO-like influences in NW Argentina using nonlinear time series analysis methods," *Climate Dynamics*, vol. 21, no. 3-4, pp. 317–326, 2003.

[22] T. K. March, S. C. Chapman, and R. O. Dendy, "Recurrence plot statistics and the effect of embedding," *Physica D: Nonlinear Phenomena*, vol. 200, no. 1-2, pp. 171–184, 2005.

[23] T. Lichtenegger, "Local and global recurrences in dynamic gas-solid flows," *International Journal of Multiphase Flow*, vol. 106, no. 9, pp. 125–137, 2018.

[24] J. P. Zbilut, M. Koebbe, H. Loeb, and G. Mayer-Kress, "Use of recurrence plots in the analysis of heart beat intervals," in *Proceedings of the IEEE Conference on Computers in Cardiology*, IEEE Computer Society Press, Chicago, IL, USA, September 1990.

[25] J. M. Nichols, S. T. Trickey, and M. Seaver, "Damage detection using multivariate recurrence quantification analysis," *Mechanical Systems and Signal Processing*, vol. 20, no. 2, pp. 421–437, 2006.

[26] A. Spiridonov, "Recurrence and cross recurrence plots reveal the onset of the mulde event (silurian) in the abundance data for baltic conodonts," *The Journal of Geology*, vol. 125, no. 3, pp. 381–398, 2017.

[27] N. Marwan, N. Wessei, U. Meyerfeldt, A. Schirdewan, and J. Kurths, "Recurrence plot based measures of complexity and theirs application to heart rate variability data," *Physics Reviews*, vol. 66, no. 2, pp. 620–702, 2002.

[28] J. E. Naschitz, I. Rosner, M. Rozenbaum et al., "Patterns of cardiovascular reactivity in disease diagnosis," *QJM: International Journal of Medicine*, vol. 97, no. 3, pp. 141–151, 2004.

[29] N. Marwan and A. Meinke, "Extended recurrence plot analysis and its application to ERP data," *International Journal of Bifurcation and Chaos*, vol. 14, no. 2, pp. 761–771, 2004.

[30] H. Josiński, A. Michalczuk, A. Świtoński, A. Szczęsna, and K. Wojciechowski, "Recurrence plots and recurrence quantification analysis of human motion data," in *Proceedings of the International Conference of Numerical Analysis & Applied Mathematics*, pp. 973–977, Rodos, Greece, June 2016.

[31] I. T. Takakura, R. A. Hoshi, M. A. Santos et al., "Recurrence plots: a new tool for quantification of cardiac autonomic nervous system recovery after transplant," *Brazilian Journal of Cardiovascular Surgery*, vol. 32, no. 4, pp. 245–252, 2017.

[32] C. Kyrtsou and C. E. Vorlow, "Complex dynamics in macroeconomics: a novel approach new trends in macrockonomics," *New Trends in Macroeconomics*, Springer, Berlin, Germany, 2005.

[33] N. Bigdeli and K. Afshar, "Characterization of Iran electricity market indices with pay-as-bid payment mechanism," *Physica A: Statistical Mechanics and Its Applications*, vol. 388, no. 8, pp. 1577–1592, 2009.

[34] W. S. Chen, "Use of recurrence plot and recurrence quantification analysis in Taiwan unemployment rate time series," *Physica A: Statistical Mechanics and Its Applications*, vol. 390, no. 7, pp. 1332–1342, 2011.

[35] A. K. Sen, R. Longwic, G. Litak, and K. Gorski, "Analysis of cycle-to-cycle pressure oscillations in a diesel engine," *Mechanical Systems and Signal Processing*, vol. 22, no. 2, pp. 362–373, 2008.

[36] M. M. İspirli and A. E. Yilmaz, "Tracking failure and recurrence plot analysis for three different levels in the discharge on epoxy resin," *Electrical*, Electronics & Biomedical Engineering, 2017.

[37] K. Kecik, K. Ciecielag, and K. Zaleski, "Damage detection of composite milling process by recurrence plots and quantifications analysis," *International Journal of Advanced Manufacturing Technology*, vol. 89, no. 1-4, pp. 133–144, 2017.

[38] V. L. Hilarov, "Detection of the fracture zone by the method of recurrence plot," *Physics of the Solid State*, vol. 59, no. 12, pp. 2401–2406, 2017.

[39] A. Weremczuk, M. Borowiec, M. Rudzik, and R. Rusinek, "Stable and unstable milling process for nickel superalloy as observed by recurrence plots and multiscale entropy," *Eksploatacja i Niezawodnosc-Maintenance and Reliability*, vol. 20, no. 2, pp. 318–326, 2018.

[40] T. H. Mohamad, Y. Chen, Z. Chaudhry, and C. Nataraj, "Gear fault detection using recurrence quantification analysis and support vector machine," *Journal of Software Engineering and Applications*, vol. 11, pp. 181–203, 2018.

[41] N. Marwan, J. Kurths, and P. Saparin, "Generalised recurrence plot analysis for spatial data," *Physics Letters A*, vol. 360, no. 4-5, pp. 545–551, 2007.

[42] V. Houshyarifar and M. C. Amirani, "Early detection of sudden cardiac death using poincaré plots and recurrence plot-based features from HRV signals," *Turkish Journal of Electrical Engineering and Computer Sciences*, vol. 25, no. 2, pp. 1541–1553, 2017.

[43] H. Ziaei-Halimejani, R. Zarghami, S. S. Mansouri, and N. Mostoufi, "Data-driven fault diagnosis of chemical processes based on recurrence plots," *Industrial & Engineering Chemistry Research*, vol. 60, no. 7, pp. 3038–3055, 2021.

[44] M. I. Labib and A. A. Nahid, "OptRPC: a novel and optimized recurrence plot-based system for ECG beat classification," *Biomedical Signal Processing and Control*, vol. 72, Article ID 103328, 2022.

[45] M. Fukino, Y. Hirata, and K. Aihara, "Coarse-graining time series data: recurrence plot of recurrence plots and its application for music," *Chaos An Interdisciplinary Journal of Nonlinear Science*, vol. 26, no. 2, pp. 023116–023744, 2016.

[46] R. J. Urbanic, "Image analysis using recurrence quantification plots, surface modeling and fused deposition modeling tools to design 3 dimensional models," *Computer-Aided Design and Applications*, vol. 15, no. 5, pp. 707–719, 2018.

[47] M. Abid and G. Lefebvre, "Improving indoor geomagnetic field fingerprinting using recurrence plot-based convolutional neural networks," *Journal of Location Based Services*, vol. 14, no. 4, pp. 1–27, 2020.

Hindawi
Journal of Environmental and Public Health
Volume 2023, Article ID 9756316, 1 page
https://doi.org/10.1155/2023/9756316

Retraction

Retracted: Public View of Public Health Emergencies Based on Artificial Intelligence Data

Journal of Environmental and Public Health

Received 26 September 2023; Accepted 26 September 2023; Published 27 September 2023

This article has been retracted by Hindawi following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of one or more of the following indicators of systematic manipulation of the publication process:

(1) Discrepancies in scope

(2) Discrepancies in the description of the research reported

(3) Discrepancies between the availability of data and the research described

(4) Inappropriate citations

(5) Incoherent, meaningless and/or irrelevant content included in the article

(6) Peer-review manipulation

The presence of these indicators undermines our confidence in the integrity of the article's content and we cannot, therefore, vouch for its reliability. Please note that this notice is intended solely to alert readers that the content of this article is unreliable. We have not investigated whether authors were aware of or involved in the systematic manipulation of the publication process.

Wiley and Hindawi regrets that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our own Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

References

[1] S. Zhang, C. Chu-ke, H. Kim, and C. Jing, "Public View of Public Health Emergencies Based on Artificial Intelligence Data," *Journal of Environmental and Public Health*, vol. 2022, Article ID 5162840, 11 pages, 2022.

Hindawi
Journal of Environmental and Public Health
Volume 2022, Article ID 5162840, 11 pages
https://doi.org/10.1155/2022/5162840

Research Article

Public View of Public Health Emergencies Based on Artificial Intelligence Data

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Received 25 May 2022; Revised 25 June 2022; Accepted 5 July 2022; Published 5 August 2022

Academic Editor: Sivakumar Pandian

In the current environment where the network and the real society are intertwined, the network public view of public emergencies has involved in reality and altered the ecology of communal public views in China. A new online court of influence has been created, and it affected the trend of events. As the main type of public emergencies, public health emergencies are directly related to people's health and life insurance. Therefore, the public often pays special attention. At present, correct media guidance plays an irreplaceable and important role in calming people's hearts and stabilizing social order. If news and public view are left unchecked, it is likely to cause panic among the people. However, in reality, public view research has always been a research object that is difficult to intelligentize and quantify. Based on such a realistic background, the article conducts a research on public view of public health emergencies based on artificial intelligence data analysis. This study designs an expert system for network public view and optimizes the algorithm for the key problem: SFC deployment. Finally, the system was put into real news and public opinion research on new coronavirus epidemic prevention, and experimental tests were carried out. The experimental results have shown that in the new coronavirus incident, the nuclear leakage incident, and the epidemic prevention policy, the data obtained by the public through the Internet are 50%, 68.06%, and 64.35%, respectively. For the system function in this study, both ICSO and IPSO are far better than the optimization results of CSO and PSO. For most of the test functions, IPSO is better than ICSO's optimization results, which better fulfills the needs of the research content. This study will make an in-depth analysis of the evolution process of online public opinion on public emergencies from the macro-, meso-, and micro-perspectives, in order to analyze the dissemination methods and internal evolution mechanism of various public emergencies of online public opinion, which provides countermeasures and suggestions for the government to guide and manage network public opinion.

1. Introduction

At the moment when the new coronavirus epidemic is raging, the public's attitude towards news and public view on public health emergencies are very sensitive. In the era of new network media, the Internet is changing the public view environment of the current society. People express their attitudes and views on social focus issues and hot topics through the Internet. This information reflects social public view and sentiment and constitutes an important content of network public view. However, network public view data are often isolated in various data sources on the Internet, such as Weibo, forums, and news websites, forming an island of public view information. In this context, timely warning of emerging online public view and helping the government and public view managers to take relevant initiatives to control the development of people's thoughts have become the focus of research.

In the past few decades, many authors have done extensive studies in public health emergencies' news. Cacciatore M A summarized public view research on misinformation in the science/health field and finds that almost all such work at work sees misinformation as a cause for concern. While there is little research to completely eliminate the impact of misinformation on public view, choices around packaging and delivering corrective

information show promise in reducing the impact of misinformation [1]. Gkiouras K researched all articles on COVID-19 as of March 14, 2020, in five high-impact journals, extracted news and social media discussions for each article in each issue, and assessed PHEIC open data calls for degree of compliance. His research aims to analyze global public health view in the context of COVID-19. However, his research method has limitations, which makes the research speed and progress very slow [2]. Lin C took into account that the application of smart technology has already worked in hospital, quarantine establishments, and common areas and has attracted extensive media and public attention. Based on this, he conducted a survey, which showed that the Chinese people generally have a positive attitude towards "anti-epidemic intelligent systems" and recognized their dedication to decreasing healthcare load and the transmission of the virus [3]. Soojung aims to investigate the impact of news reviews on user-perceived public view, attribution, and policy view. In the process, he examined the impact of reviews on perceived public view based on exemplification theory and uses attribution theory to explain the impact of perceived public view on attribution and policy view. The results have shown that attribution in news reviews has a main effect on perceived public view. Perceived public view influences one's policy view through personal attribution mediation. However, his research did not provide a measure for evaluating the urgency of public health events [4]. In the above research, one of the most difficult problems for scholars is that the evaluation criteria, speed of dissemination, public view, and other factors cannot be well quantified, so it becomes difficult to control bad public view and spread true views.

The progress and development of the times have given birth to artificial intelligence, and the data analysis of artificial intelligence has also become a hot topic of research. Ramdani *R* focused on mass social distancing (PSBB) in the context of the Indonesian government, return restrictions in Eid Mubarak (Mudik), and new normal life policy case studies. He believed that if policymakers can gain insights from online media news with the help of artificial intelligence, they can adapt to the public's preferences [5]. Babu N V reviewed the use of various artificial intelligence techniques for sentiment analysis of social media data to detect fear or depression. In this investigation, social media data consisting of text, emojis, and emojis were found by optical means to be used for emotion recognition using various artificial information, but his research did not explain the timeliness of such research system attention [6]. Hamamoto *R* attempted to study this work using genomic medicine to elucidate the pathogenesis of diseases such as cancer. His research aims to improve the prevention, diagnosis, and treatment of various diseases, and he hopes to advance Genomic Health for Personal Care, but his research did not address the significance of epigenetics to describe legacy through genomic DNA mechanisms beyond sequence [7]. Vaio A D investigated a literary corpus of data intelligence and analytics for the role and potential of improving overall decision-making processes through the lens of artificial intelligence (AI), big data, and human-machine interfaces. He provided access to insulation on major themes, quotation patterns, and publishing activity, the state of collaboration among benefactors in past research, summary data information, and analytical research contributions, but his research did not provide a cross-sectional study of what has been published in the field of data intelligence and analytics [8]. The work content of the article is to integrate the data analysis method of artificial intelligence into the research of public view and public view and build an expert system of case reasoning to study the news and public view of public health emergencies.

Artificial intelligence technology is gradually affecting all aspects of our lives. Swarm intelligence evolutionary algorithms can deal with problems such as nonderivable node transfer functions or the absence of gradient information [9, 10]. At the same time, it also promotes the development of all aspects of life [11]. Problems that were previously unsolvable by computation are also beginning to be achieved by means of artificial intelligence [12]. As a standard method of artificial intelligence, artificial neural network (ANN) imitates the principle of biological function and constructs a set of nonlinear signal processing system to solve some large-scale and complex problems of nervous system [13]. The system not only has great optimization in time cost but also has good parallel processing ability. The system designed in this study is based on this method [14]. At present, the research of artificial intelligence only focuses on the research of neuron model, pattern recognition, natural language processing, intelligent robot, and so on [15, 16]. Among them, neural network technology has developed rapidly and has been successfully applied in various fields.

2. Construction Method of News and Public View Expert System for Public Health Emergencies

2.1. Evolution of Online Public View on Public Health Emergencies. Public health emergencies not only refer to major infectious diseases, large-scale unexplained diseases, major food poisonings, and other events that seriously affect public health [17]. The main features of public health emergencies are events that seriously endanger public health, which can be broadly classified as three different kinds [18]. First, major infectious diseases and unexplained diseases are prevalent and seriously endanger public health [19]. Second is incidents that seriously endanger public health, such as severe food poisoning and occupational poisoning. The third is events that endanger public health caused by natural disasters and social security events [20].

The development of network public views evolving into public emergencies is a complex issue that needs to be understood. Among them, news websites established by traditional news organizations not only have the rights of traditional media but also use the business model of commercial websites for market-oriented operation, such as Xinhuanet, People. cn, and other independent Internet information service units [21, 22]. At present, the degree of participation of online public view in the real society is

getting deeper and deeper. Most of the problems in real society are introduced into the network [23]. Yanran Internet has become a "mirror" of real society. In the era of deep integration of the Internet and the real society, the trend of evolution, the influencing factors, and propagation paths of cyber views on public outbreaks are more difficult to approach than ever before [24]. Under this circumstance, it is very important to conduct uninterrupted investigations on the public views of network emergencies and restore the whole process of the development of network emergencies and public views [25]. Therefore, by building the public view foundation of public emergencies' network, this study comprehensively thinks the development process of people's thought of multiple public outbreak networks. This study investigates the functional relationship between the network objects of public emergencies and the objects of public views and clarifies the interaction process between various influencers during the procedure of public view promotion on the public outbreak network [26]. This fundamentally explains the reasons for the formation of online public views on sudden public events and formulates various laws with realistic explanatory power, which is of great theoretical significance [27].

2.2. Expert System for Network Public Views. With the level of experts in the field, it can solve related problems in this field, and this kind of scheme is called an expert system. So far, there are still different views on the definition of expert system, and there is no relatively unified definition. In most cases, expert systems are thought of as domain-specific computer programs. The professional knowledge and experience of experts in the field are possessed, the way of thinking of experts in the field can be imitated, and difficult problems that only a few experts and scholars in the field can solve are answered. Foreign platforms include Buzzlogic, Nielsen, Reputation Defender, and Visible Technologies. The artificial intelligence-based expert system made in this study can successfully collect online public view cases and conduct inference and integration of data, as shown in Figure 1.

The Web crawler sets the content information of the pages to be collected by setting the format of the collected pages and then continues to crawl the next-level target pages along the hyperlinks in the traversed pages. It collects Web page information and stores it for subsequent processing. To realize this system, the technical difficulty is the problem of SFC deployment. Therefore, most of the current algorithms are still heuristic algorithms, and the idea is to balance performance and loss as much as possible, so that the algorithm can achieve good performance in some performances. The heuristic algorithm seeks a better solution by optimizing the mixed integer linear programming model during calculation, which has a large room for improvement in terms of time cost and performance. In particular, for large-scale network topology, the effect of heuristic algorithm still has obvious attenuation. Considering the unique advantages of neural network in solving big data problems, this study hints a way of graph neural network to realize the deployment of NFV service function chain, as shown in Figure 2.

In recent years, neural network models have been continuously optimized and used to solve various complex problems. At present, typical neural networks include recurrent neural network (RNN), convolution neural network (CNN), and deep neural network (DNN). The characteristics of graph neural network are particularly suitable for solving node-based graph structure problems, so it can analyze the entire system in more detail when dealing with SFC deployment problems, especially when dealing with large network topologies. Compared with heuristic algorithms, the performance advantage of graph neural network will be more obvious. This is of great help for us to build an expert system for public view on the public health network and basically solves the technically difficult problems.

2.3. ARMA-GARCH Model. This model is one of the most widely used static time-series analysis models. It has three basic forms: self-querying model (AR model), mobile media model (MA model), and hybrid model (ARMA model). Essentially, the ARMA method is a basic model with limited parameters. The basic framework of static time-series analysis that meets this requirement has been perfected and widely used in many fields. This study is the research of time-series analysis with the help of ARMA model and is devoted to the research of news public view. If the transient diversity is high, then adding noise on the position has little effect, and the effect is very small. The real noise should be added to the target, not the location.

The ARCH method is improved to the GARCH method, and the basic equation is as follows:

$$r_1 = \varphi_0 + \sum_{i=1}^{R} \varphi_i r_{t-i} + \sum_{i=1}^{M} \varphi_i \varepsilon_{t-i} + \varepsilon_t, \tag{1}$$

$$\varepsilon_t = u_t \sqrt{h_t}, \tag{2}$$

$$h_t = k + \sum_{i=1}^{p} A_i \varepsilon_{t-i}^2 + \sum_{i=1}^{q} G_i h_{t-i}. \tag{3}$$

Determining similarity of numeric attribute values is as follows:

$$d_{jk1} = \sum_{m=1}^{n} w_m d\left(I_{jm}, X_m\right), \tag{4}$$

Here, $d_{jk1} = \sum_{m=1}^{n} w_m d\left(I_{jm}, X_m\right)$.

$$\sum_{m=1}^{n} W_m = 1. \tag{5}$$

Similarity determination of nonnumeric attribute values is as follows:

$$\operatorname{sim}\left(S_1, S_2\right) = \overrightarrow{V_1} \cdot \overrightarrow{V_2} = \frac{\sum_{i=1}^{n} \omega_i \omega_i}{\sqrt{\sum_{i=1}^{n} \omega_i^2} \sqrt{\sum_{i=1}^{n} \varphi_i^2}}. \tag{6}$$

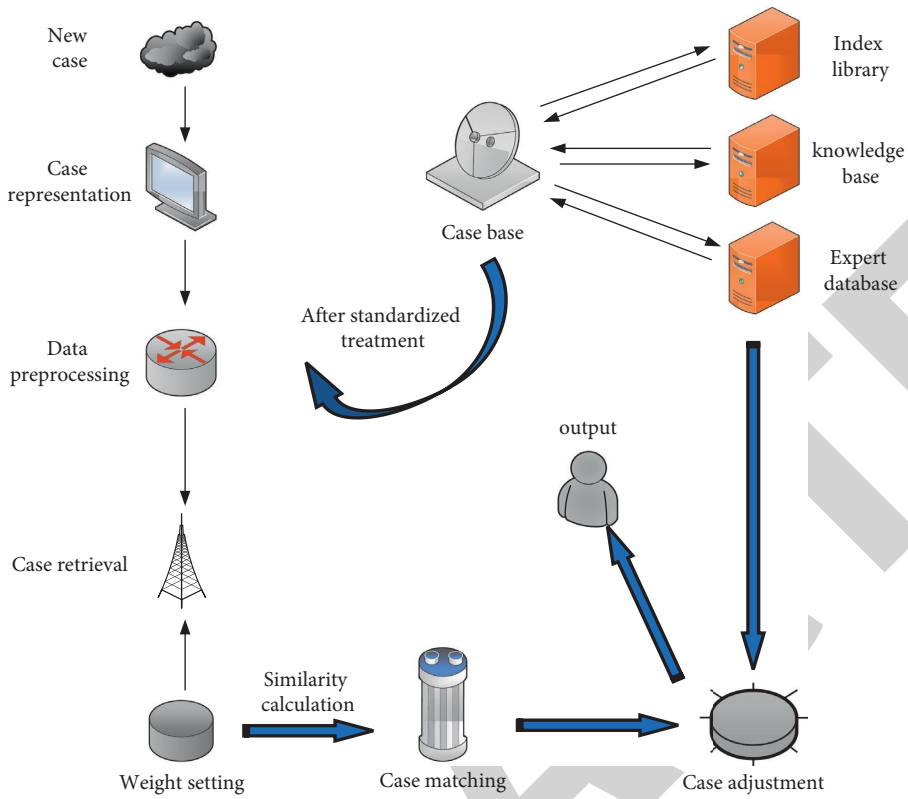

Figure 1: Expert system for case reasoning.

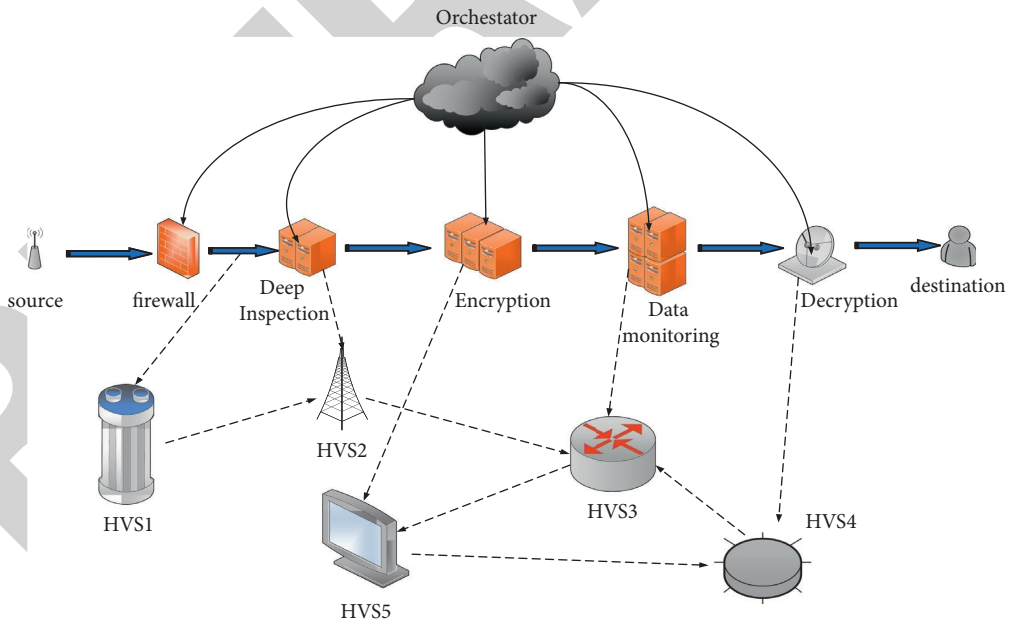

Figure 2: Schematic diagram of SFC mapping stages.

The fitness function is as follows:

$$F_i = C_{\max} - E_i, \tag{7}$$

$$E_i = \frac{1}{2}\sum_{K}\sum_{p}\left(y_i\prime - y_2\right)^2. \tag{8}$$

The following objective function is optimized to find the closest approximation function:

$$\min_{F} E(f) = \frac{1}{2}\sum_{p=1}^{p}\left[d^p - F\left(X^p\right)\right]^2 + \frac{1}{2}\lambda\|DF\|^2. \tag{9}$$

The solution of (2) is given as follows:

$$F(x) = \sum_{p=1}^{p} \omega_p G(x, x^p). \quad (10)$$

Such functions are called Green's functions, and an important example of such Green's functions is the multivariate Gauss function, and the three-layer feedforward neural network is shown in Figure 3:

$$G(x, x^p) = \exp\left(-\frac{1}{2\sigma^2}\left\|x - x^p\right\|^2\right). \quad (11)$$

This algorithm is an incremental clustering algorithm, which compares the similarity of the news to be clustered with the news sets in the existing topics one by one and finally classifies the news to be clustered as a new topic or an existing topic. It is iteratively updated according to the change increments of the connection weights and thresholds of each layer of network nodes obtained above. The iterative formulas of the network weights and thresholds are shown in the following equations:

$$W_{jk}(n+1) = W_{jk}(n) + \Delta W_{jk}, \quad (12)$$

$$V_{ij}(n+1) = V_{ij}(n) + \Delta V_{ij}, \quad (13)$$

$$\beta_k(n+1) = \beta_k(n) + \varphi\delta_k^0, \quad (14)$$

$$a_k(n+1)a_k(n) + \tau\delta_j^y. \quad (15)$$

When the corresponding weights and thresholds of each layer of neurons are completed, the learning and training stage of the neural network enters the forward propagation link again.

2.4. Introduction to Online Public View. Public view is the total of people's attitudes, feelings, views, and beliefs about social affairs and phenomena that develop and change within a certain social space. When understanding the concept of public view, it should also be understand the following three points: first, the origin of public view is public view, and public view is the collective reflection of public view. Secondly, the public view reflected by the public view is not the whole public view, but the public view that can directly affect the governor's decision-making behavior. Third, the life cycle process and changing laws of public view are accompanied by it, which directly impacting on the entire living process of public view. The two are interdependent and inseparable. Only on this basis, we can discuss the public view on the basis of public view, but the traditional social public view lies in the people and the public, which is not only difficult to capture but also fleeting. In addition, due to the limitations of investigation channels, investigators, scope of investigation, and public vigilance, even if considerable public view data are obtained, there are still doubts about timeliness, representativeness, and the authenticity of public will. With the rapid development of the Internet era, people are more and more inclined to use virtual network platforms to publish more authentic and reliable emotions and attitudes that hold public view voluntarily and immediately to form network public view.

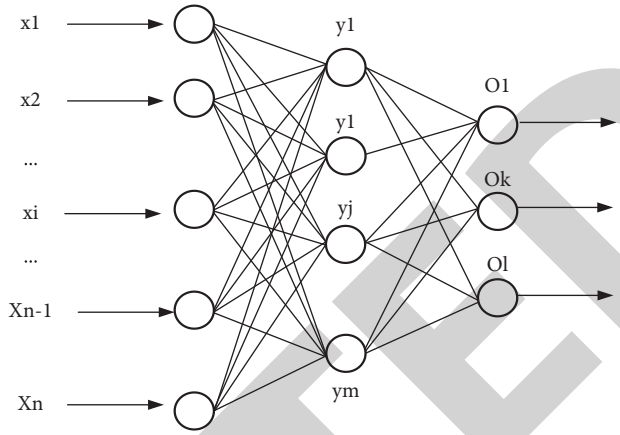

Figure 3: Three-layer feedforward neural network diagram.

3. Experiment of the Public View System of Public Health Network

3.1. Trend of Internet Public View in Public Health Outbreaks. The survey time was from October 16, 2020, to October 22, 2020. A one-week random survey was conducted on the professional questionnaire platform Questionnaire Star. A series of 216 effective forms were collected for this survey. The focus of the questionnaire design is mainly for the public's choice of the media when public health outbreak occur and the degree of trust in the media to disseminate information and other related issues, as shown in Table 1.

As can be seen from Table 1, in the new coronavirus incident, the nuclear leakage incident, and the epidemic prevention policy, the data obtained by the public through the Internet are 50%, 68.06%, and 64.35%, respectively. The data obtained through newspapers were 5.09%, 3.7%, and 2.31%. In several incidents, the public's current first channel for obtaining information is the Internet, which also confirms the importance of this study. The growing tendency of online public view on physical health events can influence the views of most people. The statistics of the acquisition channels of public emergency information are shown in Table 2.

From Table 2, it can be seen that people usually know about public health emergencies, and the views that the Internet is the most effective way to spread news account for 67.59% and 79.63%, respectively. This shows that the timeliness and openness of information transmission are very important. The level of public interest in scientific and technological information is shown in Figure 4.

As shown in the figure, the public pays the least attention to GMOs, only 7.88%, and pays the most attention to medical health, which is 82.66%. This shows that the public's attention is on issues related to themselves. Due to the dissemination of information and the refutation of rumors, the GMO issue is no longer a hot topic of public concern. Therefore, it is urgent to guide the public view on the public health situation on the Internet.

Table 1: Channels for the public to obtain information on public health events for the first time.

	Internet (%)	Newspaper (%)	Broadcast (%)	TV (%)	Message (%)	Others (%)
What channels do you usually get reports through?	80.09	1.39	0.46	15.28	1.85	0.93
Which channel did you first learn about the COVID-19 event?	50	5.09	0.93	30.67	0.93	6.48
Which channel did you first learn about the nuclear leak?	68.06	3.7	2.31	23.15	1.39	1.39
Which channel did you first learn about the epidemic prevention event?	64.35	2.31	3.7	24.51	1.39	3.7

Table 2: Access channels for information on public emergencies.

	Newspaper (%)	Broadcast and TV (%)	Internet news (%)	Talk (%)	Message (%)
Common ways to learn about public health emergencies	2.31	24.54	67.59	2.78	2.78
Which way will make the information of public health emergencies spread more quickly?	1.39	11.11	79.63	0	7.87

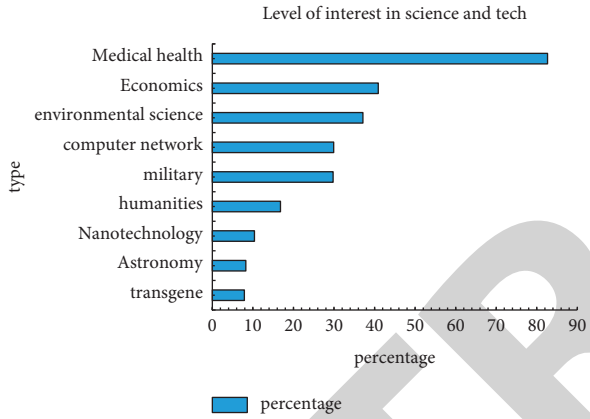

Figure 4: Public interest in scientific and technological information.

The simulation diagram of the evolution process of public views in public outbreaks is shown in Figure 5.

It shows that the development of online public view roughly includes three ways: the occurrence, the diffusion, and the subsidence, mainly in time series.

3.2. Feature Optimization Effect of the System. In the TF-IDF algorithm, the content information of the corpus is very important when calculating the IDF of a word, and it is the core factor that determines whether a word can become a keyword. Based on the Weka interface, it is able to count the profile paths of the optimized algorithms for different feature selection and analyze the impact of evaluation using the graphs. The Cauchy distribution is more suitable for relatively flat and wide curves; the Gaussian distribution is suitable for taller and narrower curves.

The results of the improvement profile are shown in Figure 6.

As shown in the figure, as the number of features increases, DF/TF shows better accuracy, and the gradual growth of F value indicates that the quantity of characteristic entries does not take into account the enhancement of TF, but the improvement is not significant. At the numerical

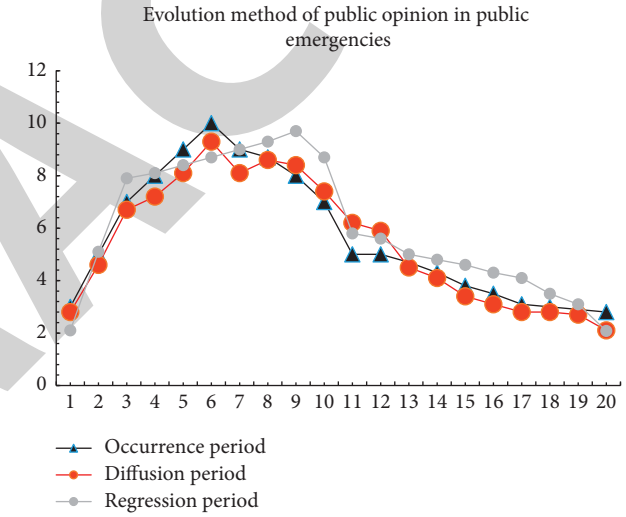

Figure 5: Simulation of the evolution process of public view on public emergencies.

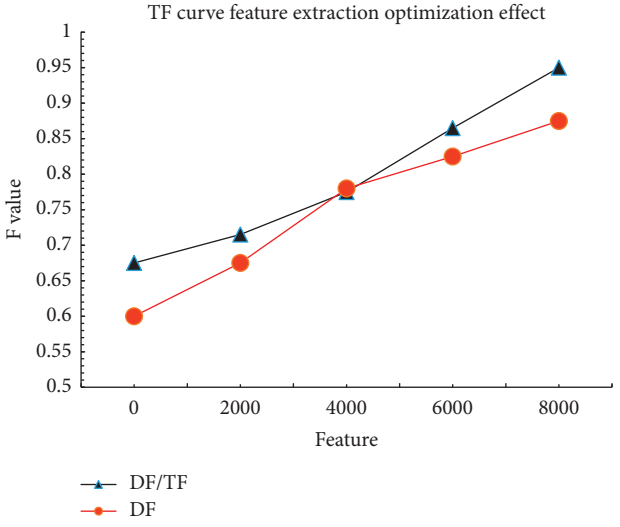

Figure 6: TF feature extraction optimization effect curve.

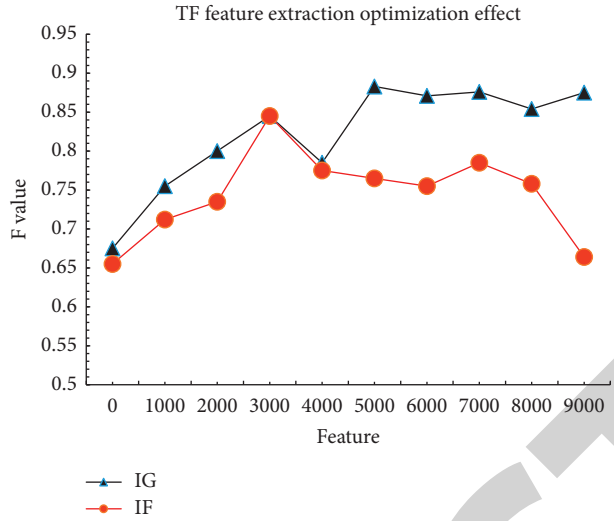

Figure 7: IF feature extraction optimization renderings.

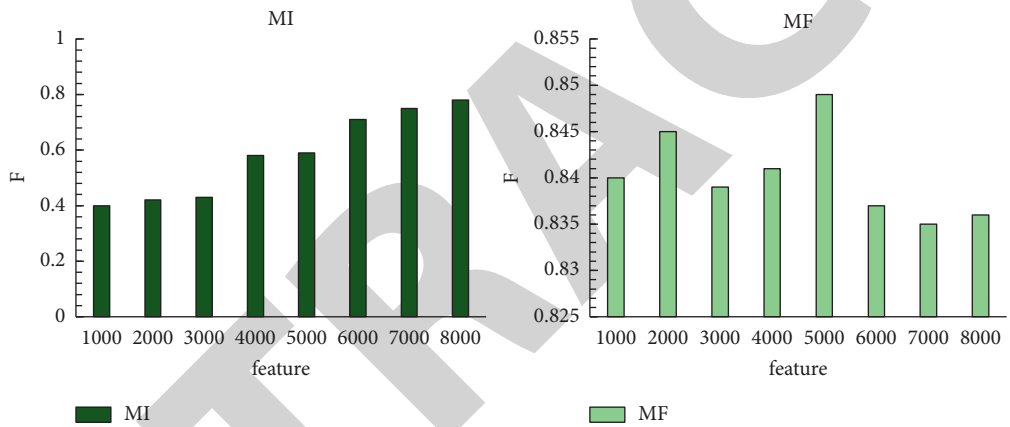

Figure 8: MI feature extraction optimization effect.

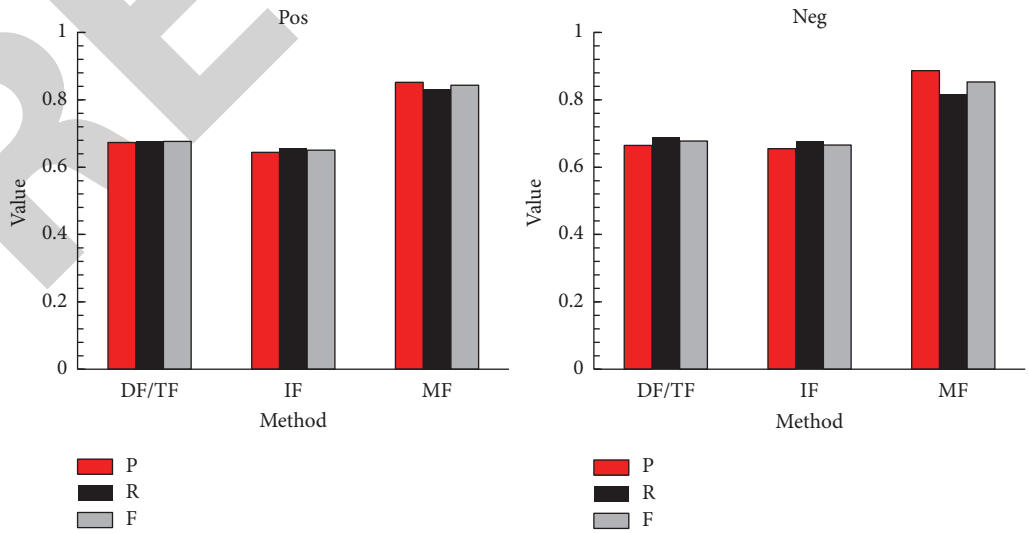

Figure 9: Comparison of three methods in the Bayesian algorithm under different classifier modes.

Table 3: Standard test functions.

Standard test set function	Code	Define domain scope	Optimal solution
Sphere	F1	[−5.12, 5.12]	0
Weight sphere	F2	[−5.12, 5.12]	0
Rotated hyper-ellipsoid	F3	[−65.536, 65.536]	0
Rosenbrock	F4	[−5.12, 5.12]	0
Rastrigin	F5	[−2.048, 2.048]	0
Schwefel	F6	[−5.12, 5.12]	0
Griewangk	F7	[−500, 500]	−n × 418.9829
Sum of different powers	F8	[−600, 600]	0
Ackley	F9	[−1, 1]	0

Table 4: Relevant parameter settings of the algorithm.

Algorithm	Parameter
PSO	$C1 = c2 = 1, w = 0.729$
IPSO	$C1 = c2 = 2.0$, $w \in [0.4, 0.9]$, $\mathrm{Mu} \in [0.001, 0.009]$, $\mathrm{Dc} = 1$, $\mathrm{Co} = 9$
CSO	$N_r = 0.05N, Nh = 0.5N, N_c = N - N_r - N_h, G = 5, C1 = 0.5 \times (1 - \omega)$
ICSO	$\mathrm{Q} = 0.2 \times (1 - \omega), \omega\epsilon[0.4, 0.9], \mathrm{Mu}\epsilon[0.001, 0.009], \mathrm{D_c} = 1, \mathrm{C_0} = 1$

When $D = 20$, the optimization results of the improved algorithm and other algorithms are shown in Table 5.

value of 4000 entries, it even has no favorable results. The IF feature extraction enhancement effect diagram is shown in Figure 7.

As shown in the figure, in the IF characteristic selection evaluation, it shows that the overall optimization effect of the IG curve is better than that of the IF, and the effect is the best when the project reaches about 4500.

The MI feature extraction optimization effect diagram is shown in Figure 8.

The effect of MI optimization is the most obvious. After optimization, as the number of features increases, the value of MF is much larger than that of MI, but the upward trend is slower than that of MI. The effect is most obvious when the number of features reaches 5000.

Because feature extraction is based on the LDA model, a simple classifier can be built through Weka to verify the optimization effect of the LDA model, as shown in Figure 9.

As shown in the figure, the R value of the DF/TF algorithm in the POS mode is the highest, which is 0.678; the R value in the Neg mode is the highest, which is 0.687. The IF algorithm has the highest R value in POS mode, which is 0.657; the R value in Neg mode is the highest, which is 0.675. It shows that both DF and IF are greatly affected by the LDA model and are significantly affected by the number of feature extractions. When the topic extraction mode is not introduced, the accuracy and various indicators of DF and MF are not high.

3.3. Parameter Description. The worst fitness dimension information of each group is extracted. Except for the dimension to be optimized, other dimensions are replaced by the corresponding dimension of the individual with the worst fitness in the corresponding group, and the fitness is updated. Table 3 lists the 9 standard test set functions.

Table 4 is the relevant parameter settings of the algorithm.

In dimension 20, for most test functions, IPSO optimization results and most test functions are much better, and the results are much higher than expected. According to the relevant parameter settings of the algorithm in this study, it is found that the ICSO and IPSO algorithms converge to the global optimum for 200 iterations at the latest, which is just the end of a round of collaborative optimization, which verifies the efficiency of the algorithm.

4. Public View on Public Health Events

4.1. Characteristics of Public Health Emergencies. A public medical outbreak should have the following showings: one is suddenness and unpredictability. In fact, it is a way of popping into people's lives without warning and warning. Second, the event may or may seriously endanger public health, and the occurrence of the event is related to the health of a considerable number of people. Third, it will take a long time for the occurrence and processing of the incident, not temporary, to eliminate the impact of the incident on public health. Fourth, the scope of the activity is relatively broad, and its impact is not limited to one area or a relatively closed environment.

4.2. Interpersonal Network of Netizens. Netizens are an important factor affecting the development of public emergencies, and the irrationality of netizens will lead to public opinion crisis. There is a complex connection relationship among netizens, and this connection relationship is the basis of the evolution of public view. From the perspective of the whole process, the evolution of network public view itself is a complex system. There are a large number of netizens participating in the evolution of network public view, especially in the promotion of network public view in public health emergencies. Because such incidents cause strong psychological panic among netizens, when such

Table 5: Comparison of optimization results between the improved algorithm and other algorithms.

Code	Algorithm	Best value	Worst value	Average value	Standard deviation
F1	CSO	3.07373	3.56057	4.631186	3.294335
	ICSO	5.45399	3.83147	3.83160	3.63484
	PSO	7.30844	2.7371	6.66691	3.14971
	IPSO	5.19519	3.40450	5.26510	3.50433
F2	CSO	2.32091	5.87995	9.21804	5.70177
	ICSO	2.00196	3.04395	3.04399	2.88774
	PSO	4.17123	6.73061	6.96163	6.36458
	IPSO	2.20978	3.75340	3.75340	3.56097
F3	CSO	1.16956	1.71173	4.13946	1.77890
	ICSO	2.79917	7.72086	1.73732	8.75843
	PSO	4.70869	3.53439	3.53487	3.35293
	IPSO	0.00000	0.00000	0.00000	0.00000
F4	CSO	2.95535	1.26578	1.54050	1.17593
	ICSO	2.91668	2.75960	4.54343	2.56309
	PSO	3.06061	1.24926	1.25100	1.18497
	IPSO	6.34101	9.06355	2.29799	1.00314
F5	CSO	4.21706	7.128860	6.58541	2.88017
	ICSO	1.23714	4.27886	1.54576	5.36161
	PSO	7.14290	7.46331	7.27336	2.90407
	IPSO	2.46550	5.07142	1.18985	4.57752
F6	CSO	5.96975	2.28840	1.44269	1.65445
	ICSO	0.00000	0.00000	0.00000	0.00000
	PSO	0.00000	0.00000	0.00000	0.00000
	IPSO	0.00000	0.00000	0.00000	0.00000
F7	CSO	−3.01470	−2.30554	−2.60096	6.30605
	ICSO	−8.37966	−8.37966	−8.37966	5.75215
	PSO	−6.36298	−5.01739	−5.71437	1.24272
	IPSO	−8.37966	−8.37966	−8.37966	5.75215
F8	CSO	0.00000	4.68400	7.58195	4.20334
	ICSO	0.00000	0.00000	0.00000	0.00000
	PSO	0.00000	0.00000	0.00000	0.00000
	IPSO	0.00000	0.00000	0.00000	0.00000
F9	CSO	2.89140	1.49630	3.58117	1.41761
	ICSO	1.27171	5.89826	5.89857	0.00000
	PSO	2.07063	1.57252	1.57454	0.00000
	IPSO	0.00000	0.00000	0.00000	0.00000
F10	CSO	3.99680	2.01332	3.65954	2.32901
	ICSO	7.54952	754952	7.54952	0.00000
	PSO	4.44089	4.44089	4.44089	0.00000
	IPSO	4.44089	4.44089	4.44898	0.00000

incidents are exposed on the Internet, it will cause a large number of netizens to discuss in a very short period of time. Different individual netizens have different views on the event and influence each other. With the development of the mobile Internet, more and more netizens have exposed topics and events through mobile devices that are easy to cause heated discussions among the whole people. It pays attention to the progress of events and expresses views anytime and anywhere, which greatly increases the complexity of the evolution and guidance of network public view. If the more real evolution of Internet public view is to be restored, it is necessary to analyze the interpersonal network of netizens, the main body of Internet public view participation, to set up a realistic interpersonal network of netizens. The openness and transparency of network information can help to improve the public's awareness of emergencies and increase the public's attention to public emergencies.

Network organizations can be divided into organizations with leaders and organizations without leaders. The interpersonal network of netizens is a complex network, and the connection between netizens determines the path of netizens' view exchange, which affects the evolution of network public view. In this study, we take Weibo as the data source of public view on public health outbreaks, so it can establish a practical interpersonal network by analyzing the mutual influence relationship between Weibo users. The interaction among microblog users includes behaviors such as following, forwarding, commenting, and liking, which determine the popularity of public view and affect the evolution of online public view of events. At the same time, this mutual attention, forwarding, comments, and other behaviors constitute the

connection between netizens and, together with the netizen nodes, form the netizen's interpersonal relationship network. Classification of network nodes is as follows: one is the opinion leaders and representatives of the organization, and the other is the followers of the opinion leaders and representatives of the organization.

4.3. Public Communication of AI. Science communication goes from popular science to public understanding of science and advocates "dialogue." The community of scientists should change its own image, change its role, and actively stand in the front line of science communication, which is also the requirement of the times. Only when the public supports the cause the scientific cause can move forward. Whether online or offline, it should pay attention to the doubts and concerns of the public in a timely manner and give responses through the media or mass media. For example, in the man-machine war, scientists can interpret the Alpha Dog's victory function to the public and at the same time answer the public's concern about "whether artificial intelligence will surpass human intelligence," and the public will get a more comprehensive know.

During science communication, although the scientific community has certain interests, the safety and ethical issues of artificial intelligence should be publicized as openly, transparently, and thoroughly as possible. Only when the risk is recognized, the public can better avoid it. As a scientist of technological invention, the more he hides behind the science communication, the less he will get the support of the public, and then, the development of the scientific cause will be hindered.

Artificial intelligence is a multidisciplinary technology, and its development is always inseparable from the philosophical perspective. Throughout history, concern for technology has always existed. As artificial intelligence is getting closer and closer to human "intelligence," there will be more and more humanistic concerns, and there will be no less ethical calls and criticisms. Therefore, in this process, the scientific community needs to communicate and explain constantly and negotiate with the humanities scholars to resolve the existing contradictions.

5. Conclusions

For the network public view caused by emergencies in the network, the traditional processing and analysis mode is no longer suitable, replaced by the analysis mode of informatization, dataization, and intelligent technology. Based on the previous analysis and discussion, the big data technology is introduced into the network public view of public health security. Based on the characteristics, working principle, and composition of big data, the application and advantages of big data in network public view management are studied, and the combination and balance point of big data and network public view management are found. This article introduces the evolution of network public view on public health outbreaks. In view of this situation, an expert system for network public view is proposed. Aiming at the technical difficulty in the system SFC deployment, the method of graph neural network is used to realize it. Three regression modes of the autoregressive moving average model are introduced to complete the construction of the system. Experiments were carried out on the trend of network public view in public health emergencies, the feature optimization effect, and parameter setting of the system, and the research on public view on public health emergencies based on artificial intelligence data analysis was well completed. In future research, such a system can be extended to more news and public view research, with its diversity of systems.

Data Availability

This article does not cover data research. No data were used to support this study.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

Acknowledgments

This work was sponsored in part by National Social Science Foundation of China (20BXW113).

References

[1] M. A. Cacciatore, "Misinformation and public view of science and health: approaches, findings, and future directions," *Proceedings of the National Academy of Sciences*, vol. 118, no. 15, pp. 214–243, 2021.

[2] K. Gkiouras, M. P. Nigdelis, and M. G. Grammatikopoulou, "Tracing open data in emergencies: the case of the COVID-19 pandemic," *European Journal of Clinical Investigation*, vol. 50, no. 9, pp. 71–89, 2020.

[3] C. Lin, "Public perception and reception of robotic applications in public health emergencies based on a questionnaire survey conducted during COVID-19," *International Journal of Environmental Research and Public Health*, vol. 18, no. 7, pp. 32–87, 2021.

[4] C. Soojung, "The influence of news comments on facebook users' perceived public view, attribution, and own policy view," *Journal of Cybercommunication Academic Society*, vol. 34, no. 3, pp. 271–313, 2017.

[5] R. Ramdani and E. P. Purnomo, "Big data analysis of COVID-19 mitigation policy in Indonesia: democratic, elitist, and artificial intelligence," *IOP Conference Series: Earth and Environmental Science*, vol. 717, no. 1, Article ID 012023, 2021.

[6] N. V. Babu and E. Kanaga, "Sentiment analysis in social media data for depression detection using artificial intelligence: a review," *SN Computer Science*, vol. 3, no. 1, pp. 32–49, 2021.

[7] R. Hamamoto, M. Komatsu, and K. Takasawa, "Epigenetics analysis and integrated analysis of multiomics data, including epigenetic data, using artificial intelligence in the era of precision medicine," *Biomolecules*, vol. 10, no. 1, pp. 77–89, 2020.

[8] A. D. Vaio, R. Hassan, and C. Alavoine, "Data intelligence and analytics: a bibliometric analysis of human–Artificial intelligence in public sector decision-making effectiveness," *Technological Forecasting and Social Change*, vol. 174, no. 8, pp. 97–104, 2022.

Hindawi
Journal of Environmental and Public Health
Volume 2023, Article ID 9848042, 1 page
https://doi.org/10.1155/2023/9848042

Retraction

Retracted: High-Temperature-Resistant, Clean, and Environmental-Friendly Fracturing Fluid System and Performance Evaluation of Tight Sandstone

Journal of Environmental and Public Health

Received 10 October 2023; Accepted 10 October 2023; Published 11 October 2023

This article has been retracted by Hindawi following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of one or more of the following indicators of systematic manipulation of the publication process:

(1) Discrepancies in scope

(2) Discrepancies in the description of the research reported

(3) Discrepancies between the availability of data and the research described

(4) Inappropriate citations

(5) Incoherent, meaningless and/or irrelevant content included in the article

(6) Peer-review manipulation

The presence of these indicators undermines our confidence in the integrity of the article's content and we cannot, therefore, vouch for its reliability. Please note that this notice is intended solely to alert readers that the content of this article is unreliable. We have not investigated whether authors were aware of or involved in the systematic manipulation of the publication process.

Wiley and Hindawi regrets that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our own Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

References

[1] M. Wang, H. Cheng, J. Wei, K. Zhang, D. Cadasse, and Q. Qin, "High-Temperature-Resistant, Clean, and Environmental-Friendly Fracturing Fluid System and Performance Evaluation of Tight Sandstone," *Journal of Environmental and Public Health*, vol. 2022, Article ID 5833491, 7 pages, 2022.

Hindawi
Journal of Environmental and Public Health
Volume 2022, Article ID 5833491, 7 pages
https://doi.org/10.1155/2022/5833491

Research Article

High-Temperature-Resistant, Clean, and Environmental-Friendly Fracturing Fluid System and Performance Evaluation of Tight Sandstone

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Received 3 July 2022; Revised 15 July 2022; Accepted 16 July 2022; Published 3 August 2022

Academic Editor: Sivakumar Pandian

Hydraulic fracturing, as an oil-water well stimulation and injection technology, is particularly important in the production and stimulation of low-permeability oil and gas fields, and the performance of the fracturing fluid directly affects the success of the fracturing operation. Compared with traditional water-based fracturing fluids, clean fracturing fluids have the advantages of strong sand-carrying ability and easy gel breaking with no residue. Aiming at the problem of poor temperature resistance and shear resistance of the clean fracturing fluid, based on previous research, this paper selects a high-temperature-resistant clean fracturing fluid system and evaluates the performance of the system. The research results show that the system has better rheological properties, better sand-carrying performance, shorter gel-breaking time, and less damage to the reservoir.

1. Introduction

Fracturing technology is famous for the shale gas revolution in the United States, but as early as 1947, American Stanolind oil and gas company conducted the first hydraulic fracturing experiment in Hugoton oilfield in southwest Kansas. On March 17, 1949, Halliburton carried out the first commercial fracturing construction in Verma, Oklahoma, and Archer County, Texas. Since then, the technology has been widely adopted by exploration and production companies around the world to improve or extend the production capacity of oil wells [1, 2]. At present, there are nearly 2.5 million fracturing operations worldwide. China began to study hydraulic fracturing technology in the 1950s and began to test it in the Yanchang oil mine in 1952. In 1973, Daqing Oilfield began to use hydraulic fracturing as an important technical measure to increase production and injection, which has a history of 30 years. With the rise of domestic shale gas development, PetroChina, Sinopec, and CNOOC have also carried out a large number of hydraulic fracturing operations in their respective oil fields [3]. Fracturing is a reservoir reconstruction technology that uses hydraulic action to form artificial fractures in oil and gas reservoirs and improve the fluid flow capacity in oil and gas reservoirs. Using the surface high-pressure pump group, we inject large displacement and high-viscosity liquid into the formation through the wellbore, and hold up the high pressure at the bottom of the well [4]. When the pressure exceeds the bearing capacity of the formation, cracks will be formed in the formation near the bottom of the well. We continuously inject the liquid-carrying proppant, and the fracture gradually extends forward. The proppant plays the role of supporting the fracture, forming a sand-filled fracture with a certain size and high conductivity so that oil and gas can easily flow into the well through the fracture, so as to achieve the effect of increasing production and injection [5, 6].

Hydraulic fracturing is an important means of developing low-pressure and permeable oil reservoirs [7, 8]. Using ground fracturing pumping equipment and its supporting sand mixer, the fracturing fluid is pumped into the fracturing target layer, pressing open the oil and gas layer, and forming one or several high-efficiency diversion fractures in the target oil and gas layer. Through fracturing construction, the fracturing fluid with a certain viscosity will greatly improve the fracturing construction efficiency, reduce the fluid loss to the formation, produce wider fractures and a good sand-carrying effect, and reduce the technological risk of fracturing construction, becoming a key factor in improving the success of fracturing operations. In the fracturing process, the fracturing fluid acts as a carrier to transmit pressure and transport proppant, and its performance affects the effect of the entire fracturing construction [9, 10]. With the improvement of fracturing technology requirements and the deepening of oil and gas reservoir exploration and exploitation, the use of the traditional water-based fracturing fluid can no longer meet the requirements.

The fracturing fluid is the working fluid of fracturing construction. It is a fluid with a certain viscosity, which plays the role of transferring energy, forming and extending fractures, and carrying proppant. At present, there are many kinds of fracturing fluids used at home and abroad, mainly oil-based fracturing fluid, water-based fracturing fluid, acid-based fracturing fluid, emulsion fracturing fluid, and foam fracturing fluid [11, 12]. Among them, the water-based fracturing fluid and oil-based fracturing fluid are widely used until today due to their advantages of low cost and convenient fluid preparation. Although hydraulic fracturing technology is an important technical guarantee for the stable production of oil and gas resources, it is widely used all over the world. However, "every coin has two sides," so it is hydraulic fracturing [13, 14]. Hydraulic fracturing pollutes groundwater and affects human survival and development, such as spontaneous combustion of tap water. In addition, the destruction of underground rock strata by hydraulic fracturing activities may also lead to small microearthquakes. The ideal water-based fracturing fluid should have sufficient viscosity to carry proppant, and flow back quickly after fracturing, leaving no residue in the fracture and harming the formation [15]. The clean fracturing fluid is a new type of the polymer-free water-based fracturing fluid whose main component is viscoelastic surfactant, so it is also called the viscoelastic surfactant fracturing fluid. Clean fracturing fluid systems all contain one or several surfactants, which are used as thickeners in fracturing fluids due to their viscoelastic properties [16]. The clean fracturing fluid system usually includes the cationic surfactant fracturing fluid, anionic surfactant fracturing fluid, amphoteric surfactant fracturing fluid, and non-ionic surfactant fracturing fluid.

The water-based fracturing fluid system usually contains water-insoluble substances such as polymers [16]. After the gel is broken, the water-insoluble substances in the system cannot be discharged, and the remaining residues block the rock fractures and pores, seriously reducing the formation permeability and causing secondary pollution to the formation [17, 18]. The clean fracturing fluid uses viscoelastic surfactants as thickeners, and through the synergistic action of additives such as inorganic salts, the surfactant molecules are assembled into worm-like micelles in the brine solution, and the micelles are highly entangled with each other to form a three-dimensional network, resulting in viscoelasticity so that it can meet the sand-carrying requirements without cross-linking agents [19, 20]. Compared with traditional water-based fracturing fluids, clean fracturing fluids have many advantages. It has unique rheology and low viscosity, which can effectively transport proppant. It can adjust and control the filtration. Higher viscosity can be achieved at lower dosage. It is easy to prepare, simple to construct, and easy to dissolve, and does not need too much equipment. It has no polymer, is environment-friendly, exhibits good compatibility, and has no residue, no formation damage, and high pumpability [21]. With less consumption, small friction, and strong sand-carrying capacity, the oil well has increased production significantly. It has no cross-linking agent, gel breaker, and other chemical additives, and no formation damage, and can keep the filling layer in good condition [22, 23]. In this paper, a high-temperature-resistant quaternary ammonium salt clean fracturing fluid system was synthesized, and the performance of the synthesized high-temperature-resistant quaternary ammonium salt clean fracturing fluid system was evaluated by laboratory experiments, including rheology, gel breaking, sand carrying, and core damage.

2. Materials and Methods

2.1. Determination of Temperature Resistance. Fracturing fluid stability includes thermal stability and shear stability. That is, the viscosity of the fracturing fluid will not decrease significantly under temperature rise and mechanical shear, which plays a key role in the success or failure of construction. The temperature resistance performance of the high-temperature and low-damage clean fracturing fluid system is tested using the HAAKE Mars III rotational rheometer manufactured by the Thermo Corporation of the United States. We set the shear rate of the rheometer to $170\,s^{-1}$, start the test at room temperature of 25°C, control the heating rate to be $3^{\circ}C/min \pm 0.2^{\circ}C/min$, continuously heat up to 150°C, and investigate the viscosity-temperature relationship of the clean fracturing fluid system.

2.2. Determination of Shear Resistance. In the clean fracturing fluid system, the viscoelastic surfactant molecules are entangled to form rod-like micelles, which in turn form a spatial network structure. Due to the reversibility of the micelle formation, its apparent viscosity does not change with time, even under high shear; once the shear rate decreases, the micelles can still aggregate and rewind again, thereby restoring the viscosity of the system, which is different from traditional polymer fracturing fluids. After the traditional plant arc glue fracturing fluid is sheared, the molecular chain is permanently disconnected, and the

viscosity decreases rapidly and cannot be recovered. The shear resistance of the clean fracturing fluid system with high-temperature resistance and low damage at high temperature is tested using the HAAKE Mars III rotational rheometer manufactured by the Thermo Corporation of the United States. The shear rate is set to 170 s^{-1}, the temperature is set to 120°C, and the viscosity changes are observed after 60 min of constant temperature shearing.

2.3. Determination of Gel Breaking and Residue

2.3.1. Determination of Gel-Breaking Properties. We should try to reduce the content of water-insoluble substances in the fracturing fluid and the gel-breaking ability before flowback, reduce its blocking of rock pores and sand-filling fractures, and increase the oil and gas conductivity. In the experiment, kerosene is used as the gel breaker for the clean fracturing fluid, and the effect of kerosene addition on the apparent viscosity and gel-breaking time of the clean fracturing fluid is investigated. At 25°C, kerosene is added according to the mass ratio of 3%, 7%, and 10% of the clean fracturing fluid, and the gel breaking of the clean fracturing fluid system is investigated under a constant rotational speed. We use a capillary viscometer (p = 0.1 mm) to measure the viscosity of the gel-breaking fluid at each time until the clean fracturing fluid system completely breaks the gel (<5 MPa·s).

2.3.2. Determination of Broken Gel Residue. We take two centrifuge tubes, pour the gel-breaking liquid of the clean fracturing fluid into one of the centrifuge tubes with an initial mass of m1, shake well, and fill the other centrifuge tube with water of the same quality. We put two centrifuge tubes into the rotor body symmetrically, cover the top of the centrifuge tube, and set the parameters. The rotation speed is set to 3000 r/min, and the rotation time is 30 minutes. We start the centrifugation and wait for the separation to end. After the centrifugation stops rotating, we open the centrifuge tube cover, take out the centrifuge tube with the gel-breaking solution, pour out its supernatant, then put the centrifuge tube into a 110°C constant temperature oven, dry it for 4-5 h, and then transfer it to a desiccator. The mass of the centrifuge tube is weighed by an electronic balance as m2, and the residue content of the clean fracturing fluid system after gel breaking can be obtained by m2–m1.

2.3.3. Determination of Static Sand-Carrying Performance. One of the functions of the fracturing fluid is to transport the proppant carried by it from the wellbore to the fractures in the production layer, delay the closure of the fractures, and form a sand-filled fracture zone with high conductivity in the oil and gas layer. The sand-carrying performance of the fracturing fluid mainly depends on its viscosity. As long as the fracturing fluid has a high viscosity, sand can be suspended in it, which is very beneficial to the distribution of sand in the fracture. However, the viscosity should not be too high. If the viscosity of the fracturing fluid is too high, the height of the fracture is large, which is not conducive to the generation of wide and long fractures. It is generally considered that the viscosity of the fracturing fluid is 50~150 MPa·s. If the settling speed of the proppant carried by the fracturing fluid is too fast during the transportation process, the phenomenon of sand plugging in the wellbore and uneven placement of proppant in the fracture will occur, which will have an adverse effect on the stimulation of hydraulic fracturing. Therefore, evaluating the sand-carrying ability of the fracturing fluid is one of the important indicators to investigate the performance of the fracturing fluid. The sand-carrying performance of the fracturing fluid can be initially determined by the static settling rate of the proppant.

In the static settlement test, due to the existence of bubbles in the fracturing fluid hindering the settlement of quartz sand, the sand ratio of 10% is difficult to submerge into the liquid surface and uneven distribution affects the test. Therefore, small steel balls are selected to replace quartz sand in the experiment. A series of comparative experiments are conducted between the fracturing fluid and the hydroxypropyl arc glue fracturing fluid with similar viscosity.

We pour the prepared high-temperature-resistant clean fracturing fluid system into a 100 ml graduated cylinder and place it in a constant temperature water bath (70°C, 80°C, and 90°C). After specifying the temperature, we measure the liquid surface height h of the measuring cylinder with a ruler, use a small steel ball with a diameter of 6 nuns to lightly put it on the liquid surface, press the stopwatch, record the time for the small steel ball to reach the bottom of the measuring cylinder, and use the same method to measure the settling rate.

2.3.4. Determination of Core Damage

(1) Preliminary Preparation of Flow Medium and Core. According to the SY/T5107-2005 test standard for evaluating the damage rate of the water-based fracturing fluid to core matrix permeability, kerosene is selected as the flow medium. The kerosene needs to be refined before the experiment. The process is as follows: We take a certain amount of kerosene, add silicon powder into it, stir evenly, and soak for a period to remove impurities and free water contained in the kerosene through the adsorption of silicon powder. Then, the kerosene is filtered by the filter funnel, and the kerosene filtrate is collected and degassed by a vacuum pump for 1 hour to complete the kerosene refining. The core is made of artificial quartz sand epoxy resin-cemented core. The core diameter is 2.503–2.504 cm, the core length is 4.09 cm, and the core is saturated with refined kerosene for 1 day.

(2) Penetration Damage Determination Steps

Step 1: Pour the refined kerosene and the clean fracturing fluid after gel breaking and filtration into the high-pressure container and put the saturated core into a 25 × 80 core holder. Before the experiment starts, set the parameters, including the confining pressure value of 10 MPa, constant flow value of 2.5 ml/min, and viscosity and density values of kerosene.

Step 2: Turn on the pump to pressurize so that the refined kerosene enters the core from the opposite end of the core holder along the pipeline to implement displacement. When there is a flowing medium, at the outlet, observe the flow value. When it is close to the set flow rate of 2.5 ml/min, start to record the permeability value, that is, the permeability before damage k1. The recording method is to record once every 3 minutes until the difference between the two adjacent values does not exceed 10%.

Step 3: Stop the pump after obtaining a stable pre-damage permeability k1. Close the reverse line and connect the forward line and set the viscosity and density of the gel breaker filtrate on the instrument. Turn on the pump again so that the filtrate of the gel-breaking liquid enters the core from the inlet of the positive end of the core holder. When there is broken gel filtrate at the outlet, observe the flow value. When it is close to the set flow rate of 2.5 ml/min, start recording data and time. The method of recording data is the same as that of step 2, and the stabilization time during the recording period is not less than 30 minutes.

Step 4: Stop the pump, close the forward line, and connect the reverse line. After setting the viscosity and density of refined kerosene on the instrument, follow the same steps as in step 2. The permeability after the flooding can be recorded as k2. The entire injury process is always performed at room temperature.

3. Result

3.1. System Optimization. On the basis that the concentration of the main agent erucamide epoxy is 4%, the salicylate (SAL) in sodium salicylate is used as the counterion to investigate the different molar ratios of sodium salicylate to erucamide epoxy (1.5 : 1, 1 : 1, and 0.5 : 1) on the viscosity of the clean fracturing fluid. Each fracturing fluid is tested on a Mars III rotational rheometer, the shear rate is set to 170 s^{-1}, the heating rate is controlled to be 3°C/min° ± 0.2°C/min, and the temperature is continuously increased to 150°C. The test results are shown in Figure 1.

It can be seen from Figure 1 that when the molar ratio of sodium salicylate to erucamide epoxy is 0.5 : 1 and 1.5 : 1, the fracturing fluid viscosity is always low, and the viscosity cannot reach 30 MPa·s at 130°C, indicating that it cannot effectively carry sand at high temperatures. However, when the molar ratio of sodium salicylate to erucamide epoxy is 1 : 1, the temperature resistance of the fracturing fluid is greatly improved, and the viscosity is greater than 30 MPa·s at 150°C, which meets the sand-carrying requirements at high temperatures. Therefore, choosing the molar ratio of the sodium salicylate to erucamide epoxy to be 1 : 1 is the optimal amount of counterions added.

Under the condition that the molar ratio of counterion to main agent is 1 : 1, the influence of different concentrations of main agent erucamide epoxy (2.5%, 3.5%, and 4.5%) on the viscosity of the clean fracturing fluid was investigated. The test results are shown in Figure 2.

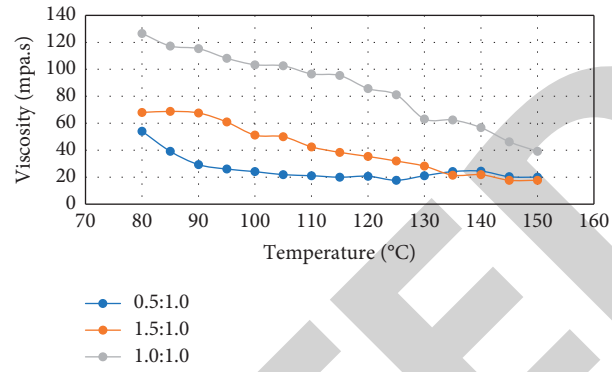

Figure 1: Rheological curve of different mole ratios of the fracturing fluid.

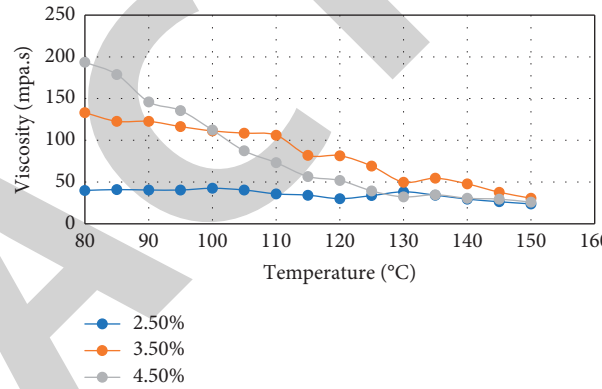

Figure 2: Rheological curve of different surfactant concentrations of the fracturing fluid.

It can be seen from Figure 2 that under a certain ratio of counterions to the main agent, the viscosity of the clean fracturing fluid increases with the increase in the mass fraction of the main agent. When the temperature exceeds 110°C, the clean fracturing fluid with a main agent concentration of 4.5% shows better temperature resistance. Although increasing the concentration of the main agent can improve the temperature resistance of the fracturing fluid, from the perspective of economy and applicability, the concentration of the main agent should generally not exceed 5%. Therefore, considering the economy and temperature resistance, it is more appropriate to choose a concentration of 4.5% of the main agent. To sum up, the clean fracturing fluid obtained when the concentration of the main agent erucamide epoxy is 4% and the molar ratio of sodium salicylate to erucamide epoxy is 1 : 1 has good high-temperature resistance.

3.2. Evaluation of Rheological Properties. The viscosity-temperature relationship of the high-temperature clean fracturing fluid was measured using a HAAKE Mars III rotational rheometer, and the experimental results are shown in Figure 3.

It can be seen from Figure 3 that with the increase in the test temperature, the viscosity of the high-temperature clean

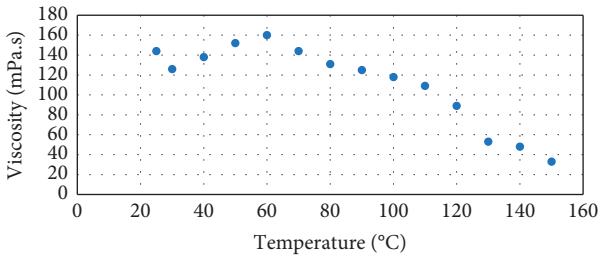

Figure 3: Viscosity data of the clean fracturing fluid at different temperatures.

fracturing fluid shows a trend of first increase and then decrease, which may be related to the increase in temperature and the increase in the solubility of viscoelastic surfactant in water. The fracturing fluid viscosity peaks at 60°C. The viscosity of high-temperature clean fracturing fluid at 120°C–150°C is 31 MPa·s. The high-temperature-resistant clean fracturing fluid still has a viscosity of more than 30 MPa·s at 150°C, indicating that the fracturing fluid system at high temperature meets the sand-carrying requirements.

It can be seen from Figure 3 that the initial viscosity of the high-temperature fracturing fluid system is 80 MPa·s at 120°C, and the viscosity of the system is stable at 70 MPa·s–90 MPa·s during the subsequent 60-min constant temperature process. Under the constant temperature and constant shear rate, the viscosity of the system will not decrease, indicating that the high-temperature fracturing fluid has good shear resistance at 120°C.

3.3. Evaluation of Static Sand-Carrying Performance. In order to evaluate the suspending ability of the high-temperature-resistant clean fracturing fluid system and the hydroxypropyl arc glue fracturing fluid to proppant, a static sand suspension performance experiment is carried out. The experimental method is that we put the high-temperature clean fracturing fluid system into a 100 ml measuring cylinder and place it in a constant temperature water bath (70°C, 80°C, and 90°C), and wait until the fracturing fluid reaches the specified temperature. We lightly place the small steel ball on the surface of the liquid, press the stopwatch, and record the time t when the small steel ball reaches the bottom of the measuring cylinder. For comparison, the same method was used to measure the suspending capacity of hydroxypropyl orphan fracturing fluids of similar viscosity. The experimental results are shown in Figure 4. For the same type of the fracturing fluid, with the increase in temperature, the settlement of small balls accelerates. Under the same temperature conditions, the settling rate of small steel balls in the high-temperature clean fracturing fluid is much lower than that in the hydroxypropyl arc glue fracturing fluid. When the temperature is 90°C, the settling rate of the small steel balls in the hydroxypropyl arc glue fracturing fluid is 3 times that of the high-temperature-resistant fracturing fluid system. This shows that compared with the light propyl arc glue fracturing fluid, the high-temperature-resistant clean fracturing fluid has good sand-carrying performance. The reason for this difference is the different sand-carrying mechanisms. The orphan fracturing fluid mainly relies on polymer thickening to carry sand, while the clean fracturing fluid mainly relies on the network structure of micelle entanglement to carry sand. It can also maintain good sand suspension performance under the viscosity.

3.4. Gel Breaking and Residue Evaluation

3.4.1. Breaking Property of the Fracturing Fluid. The breaking of the conventional vegetable gum fracturing fluid or the synthetic polymer fracturing fluid is chemical destruction; that is, the polymer chain is broken by the oxidation of the breaker so that the viscosity of the solution is rapidly reduced. The clean fracturing fluid is different; it mainly breaks the gel through contact with cinnamon or the formation of water. When the clean fracturing fluid is in contact with cinnamon, the organic matter of cinnamon enters the worm-like micelle structure, and the micelle swells, which can be decomposed into many single spherical micelles.

In the experiment, kerosene was used as the gel breaker of the clean fracturing fluid, and the gel breaking of the clean fracturing fluid after adding kerosene with a mass fraction of 3%, 7%, and 10% was investigated under constant shear rate at room temperature. The gel-breaking results of the high-temperature-resistant clean fracturing fluid are shown in Figure 5.

It can be seen from Figure 5 that with the increase in kerosene dosage, the fracturing fluid gel-breaking time is shortened. When the amount of kerosene was 3%, the clean fracturing fluid system completely broke the gel after continuous stirring for 40 minutes, and the viscosity of the gel-breaking fluid was less than 5 MPa·s; when the amount of kerosene was 10%, the clean fracturing fluid system was continuously stirred for 25 minutes. The glue-breaking effect has been achieved.

3.4.2. Fracturing Fluid Gel-Breaking Residue. We put the high-temperature-resistant clean fracturing fluid into the centrifuge tube, take it out for drying after high-speed centrifugation, and calculate the residue content. The results show that the gel-breaking fluid of the high-temperature-resistant clean fracturing fluid has no residue, indicating that the fracturing fluid system after gel breaking has no damage to the formation. The main component of the clean fracturing fluid is surfactant, and its molecular diameter is only 1/5000 of that of guar gum. These small organic molecules are easily soluble in water, so no residue is produced.

3.5. Core Damage Evaluation. After the fracturing fluid is filtered off, the filtrate enters the formation along the fracture wall. The fracturing fluid filtrate causes the expansion of the formation of water-sensitive minerals, which reduces the porosity of the reservoir rock matrix and reduces the reservoir permeability. Therefore, the measured value of the permeability damage rate of the fracturing fluid filtrate to the

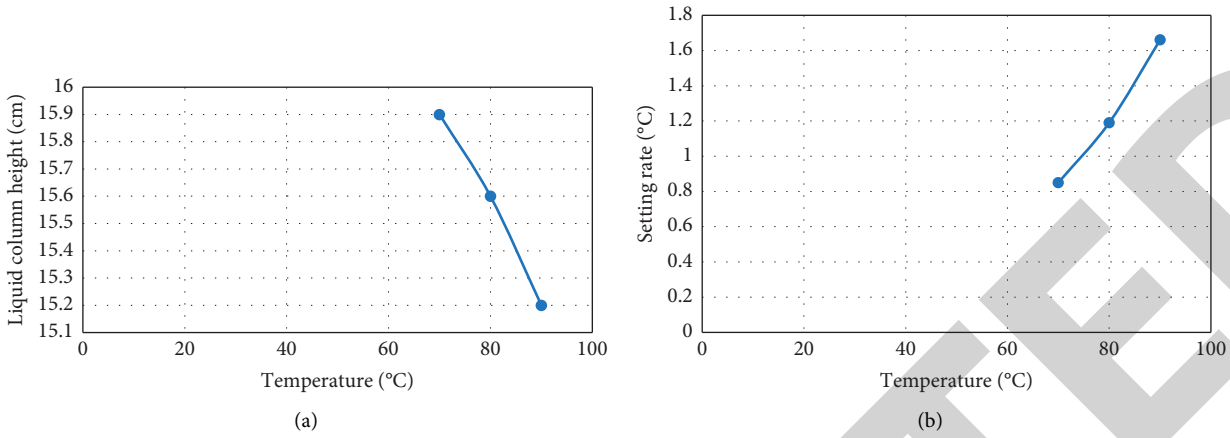

Figure 4: Evaluation of the static sand-carrying performance. (a) Liquid column height. (b) Setting rate.

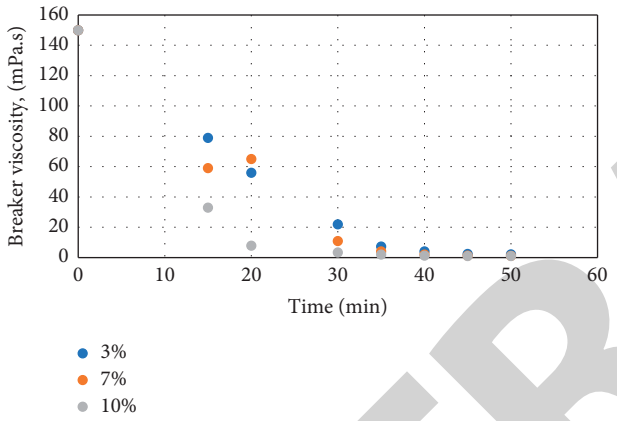

Figure 5: Effect of kerosene on breaker performance of the clean fracturing fluid.

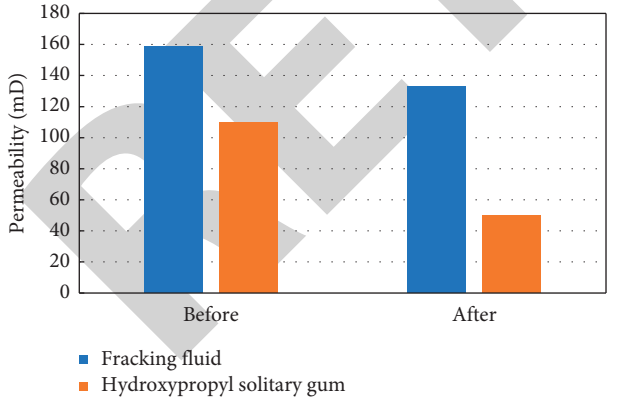

Figure 6: Core damage data of the clean fracturing fluid and the guar fracturing fluid.

reservoir matrix is also an important indicator for evaluating the quality of the fracturing fluid.

As can be seen from Figure 6, the damage rate of the high-temperature fracturing fluid to cores is 16.35%, which is much lower than the 54.5% core damage rate of the hydroxypropyl guar fracturing fluid, indicating that it has less damage to the formation and has good reservoir protection.

4. Conclusion

(1) The shear resistance of the high-temperature clean fracturing fluid system is good. In the process of the constant temperature of 120°C and shearing for 60 min, the viscosity is stable between 70 m and 90 MPa·s. Under high temperature and constant shear rate, the viscosity of the system will not decrease, indicating that the high-temperature-resistant fracturing fluid has good shear resistance performance. The high-temperature-resistant clean fracturing fluid system can automatically break the gel after encountering kerosene. With the increase in kerosene dosage, the gel-breaking time of the clean fracturing fluid is shortened. The glue-breaking fluid of the high-temperature-resistant clean fracturing fluid system has no residue.

(2) The sand-carrying performance of the high-temperature clean fracturing fluid system is better than that of the hydroxypropyl guar fracturing fluid. It can be seen from static experiments that at the same temperature, the settling rate of the small steel balls in the system is much lower than that in the hydroxypropyl guar fracturing fluid. As the temperature increases, the settling rate of the small steel balls in the fracturing fluid increases. The damage rate of the fracturing fluid system to the core is 16.35%, and the damage to the reservoir is far less than that of the hydroxypropyl guar gum fracturing fluid, which has less damage to the formation and has good reservoir protection.

Data Availability

The figures used to support the findings of this study are included in the article.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

Hindawi
Journal of Environmental and Public Health
Volume 2023, Article ID 9858063, 1 page
https://doi.org/10.1155/2023/9858063

Retraction

Retracted: Role of Radiology and Laparoscopy in Childhood Peptic Ulcer Perforation

Journal of Environmental and Public Health

Received 27 June 2023; Accepted 27 June 2023; Published 28 June 2023

This article has been retracted by Hindawi following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of one or more of the following indicators of systematic manipulation of the publication process:

(1) Discrepancies in scope
(2) Discrepancies in the description of the research reported
(3) Discrepancies between the availability of data and the research described
(4) Inappropriate citations
(5) Incoherent, meaningless and/or irrelevant content included in the article
(6) Peer-review manipulation

The presence of these indicators undermines our confidence in the integrity of the article's content and we cannot, therefore, vouch for its reliability. Please note that this notice is intended solely to alert readers that the content of this article is unreliable. We have not investigated whether authors were aware of or involved in the systematic manipulation of the publication process.

Wiley and Hindawi regrets that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our own Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

References

[1] M. Demir, M. Akın, N. Yücel, A. Unal, D. Gürel, and E. Yaşa, "Role of Radiology and Laparoscopy in Childhood Peptic Ulcer Perforation," *Journal of Environmental and Public Health*, vol. 2022, Article ID 1211499, 8 pages, 2022.

Hindawi
Journal of Environmental and Public Health
Volume 2022, Article ID 1211499, 8 pages
https://doi.org/10.1155/2022/1211499

Research Article

Role of Radiology and Laparoscopy in Childhood Peptic Ulcer Perforation

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Received 2 June 2022; Revised 29 June 2022; Accepted 5 July 2022; Published 20 July 2022

Academic Editor: Sivakumar Pandian

Objective. Peptic ulcer disease (PUD) in children is an uncommon disorder. An estimated 1.3 percent to 20 percent of people die from perforated peptic ulcers (PPU), a PUD consequence. Using a database, we assess the prevalence and prognosis of PPU in patients. We also do radiological and laparoscopic operations for PPU in young patients. In pediatric patients, sufficient accumulation of knowledge about laparoscopic repair is at the level of case reports. This study aims to assess the results in pediatric cases operated for PUP by open or laparoscopic surgery and determine the role of computed tomography (CT) in diagnosing PUP. *Methods*. Data was collected from the Department of Pediatric Surgery, Sisli Hamidiye Etfal Training and Research Hospital, Turkey, from 2015 to 2020. Patients under 18 years of age who were operated on for PUP between 2015 and 2020 were divided into two groups. Group 1 involved those patients operated by laparoscopic surgery, whereas Group 2 involved those used by open surgery. Both groups were retrospectively evaluated in terms of demographic data, clinical findings, preoperative-intraoperative findings and surgical methods (open or laparoscopic), duration of surgery, duration of nasogastric intubation, time of return to oral feeding, length of hospital stay, and postoperative complications. *Results*. 18 patients consisting of 15 boys and 3 girls were included in the study. Group 1 involved 10 patients, whereas Group 2 involved 8 patients. In Group 1, the symptom onset period was 1.6 ± 1.9 days, and in Group 2, it was 6.6 ± 6.1 days. In the erect abdominal radiographs (AXR) of 10 (58.8%) patients, the air was under the diaphragm. Six patients whose erect AXRs showed no attitude under the diaphragm but had abdominal pain and acute abdominal manifestation were given abdominal computed tomography (CT) scanning. In all patients with PUP, laparoscopic/open surgery involves primary suturing and repair by omentoplasty (Graham patch). The mean operative time was 87.0 ± 26.3 minutes in Group 1 and 122.5 ± 57.6 minutes in Group 2. The mean length of hospital stay was 3.9 ± 1.3 days in Group 1 and 5.8 ± 2.1 days in Group 2. Neither group developed any major surgical complications. *Conclusions*. Adolescents with a history of sudden onset and severe abdominal pain may present with peptic ulcer perforation even if there is no known diagnosis of peptic ulcer or predisposing factor. In cases suspected of PUP, it is vital to order and carefully examine erect AXR, which is an easy and inexpensive method. Computed tomography should be the first choice in patients without free air in ADBG but whose anamnesis and findings match peptic ulcer perforation.

1. Introduction

The number of peptic ulcer disorder (PUD) cases has increased in parallel to the widespread use of endoscopy in children [1–3]. Peptic ulcer perforation (PUP) is rare in children, and its diagnosis may usually be delayed [3]. In the pediatric population, the risk factors have been defined as ages older than ten years and male gender [4]. The most common predisposing factors reported in adults are chronic diseases such as *Helicobacter pylori* (*H. pylori*), irritable

bowel syndrome, polyarthritis, rheumatic conditions, smoking, and nonsteroidal anti-inflammatory drugs (NSAIDs) [4–8].

A quick proportion of deaths in 30 to 50 percent of patients is related to PPU, a surgical urgency. The wide range of demographics, socioeconomic level, *Helicobacter pylori* frequency, and prescription drugs makes it challenging to investigate health risks for PPU. PPU is an acute abdominal ailment that can lead to peritonitis, sepsis, and even death if left untreated. The importance of early diagnosis cannot be overstated; yet among the elderly and those with impaired immune systems, symptoms may be more challenging to detect. Diagnosis is aided by imaging and early rescue, possibly antibiotic therapy.

According to some estimates, the fatality and morbidity rate for PPU is between 25 and 30 percent. In the last three decades, several preoperative prognostic indicators for postprocedural morbidity and mortality after PPU have been reported. Although perioperative monitoring and treatment have improved over the previous several years, the death rate for patients with PPU has increased dramatically. We require a rigorous, current, evidence-based assessment of the reported earlier prognostic markers to help explain the clinical picture of patients having PPU and also to forecast and reduce deaths.

For millennia, healthy people have experienced sudden abdominal pain, nausea, vomiting, and diarrhoea, ending in death in hours or days. Poisoning has been blamed for these symptoms in the past, and individuals were sentenced to prison for doing so. At the age of 26, Henrietta Anne, the only daughter of King Charles I, perished of a sudden illness in 1670. In light of the suspicion of foul play, an autopsy was undertaken, which revealed peritonitis and then a tiny gastric hole. A PPU was not known to the doctors, who blamed a dissector knife for the stomach hole. After being authorized in Europe in 1500, necropsies grew more common in Europe between the years 1600 and 1800. As a result, stomach perforation was more common. "Every clinician, when confronted with a PPU of the stomach, should consider setting up the abdominal, stitching up the hole, and averting a probable inflammation by meticulously washing the abdominal cavity, wrote Johann Mikulicz-Radecki (1850–1905). A simple stitch closure and a piece of nearby omentum have been used to close the perforation since then, with no change in treatment. PPU is a severe surgical disease, with high mortality rates, despite the simple nature of this treatment.

The indications are so common, I scarcely believe it is necessary that everyone can miss making the correct diagnosis," concluded Edward Crisp in 1843, the first to record 50 patients of PPU. Early onset of severe, throbbing pain in the epigastric region but mainly in the shoulder, suggesting free air underneath the diaphragm, is frequent in patients with PPU. A 48-year-old man is a usual patient with PPU. He may have used prescription pain relievers like PUD or NSAIDs in the past (29%). When it comes to vomiting and nausea, 50 percent of people have these. During a physical exam, the pulse may quicken, although it seldom exceeds 90 beats per minute. Patients with arterial blood pressure less than 80 mm Hg experience shock in 5–10 percent of cases. Hypotension and a high temperature are signs that a patient may not notice until it is too late. Only 37% of patients had liver dullness completely obliterated or absent; hence, this diagnostic tool has its limitations.

Mild leukocytosis is expected to be identified in blood tests. A blood test is a primary way to rule out other conditions, such as pancreatitis. About 80–85% of the time, a standing X-ray of the abdominal area will indicate open air under the diaphragm. An abdominal ultrasound or computerised tomography (CT) scan with oral contrast is available at a few facilities. Currently, 80–90% of cases can be appropriately diagnosed using radiographic techniques. The use of high volumes of crystalloids, nasogastric suction to remove the stomach's contents, and broad-spectrum antibiotics are all used as soon as a diagnosis is obtained to help the patient survive. When a patient has been diagnosed with PPU, there are several treatment choices to consider.

Surgical techniques for PUP have been comprehensively defined in the adult population, and laparoscopic repair/laparoscopic omental patch has become the standard [1–17]. However, there is insufficient knowledge about laparoscopic repair in pediatric patients [9]. This study aims to assess the results in pediatric cases fewer than 18 years of age operated for PUP by open or laparoscopic surgery and determine the potential advantages and disadvantages of laparoscopy in the treatment of PUP in children.

2. Contributions of the Study

(i) The data was collected from Sisli Hamidiye Etfal Training and Research Hospital, Turkey, Pediatric Surgery Department, 2015–2020.

(ii) Patients under 18 who had PUP surgery between 2015 and 2020 were split into two groups for this research. Those who had laparoscopic surgery were in Group 1, and those who had open surgery were in Group 2.

(iii) Both groups were examined for demographics, clinical findings, preoperative-intraoperative findings, surgical procedures (open or laparoscopic), operation duration, nasogastric intubation duration, time to oral feeding, hospital stay, and postoperative problems.

3. Methodology

For this study, the approval no. 1635 of the Ethical Board for Clinical Research of the University of Health Sciences, Şişli Hamidiye Etfal Training and Research Hospital, dated August 11, 2020, was obtained. Patients under 18 years of age who were operated on for PUP between 2015 and 2020 were divided into two groups. Group 1 involved those patients operated by laparoscopic surgery, whereas Group 2 involved those used by open surgery. Hospital attendance within one day or shorter after the onset of symptoms was considered early attendance, whereas a period more extended than one day was regarded as late attendance. Both groups were retrospectively evaluated in terms of demographic data,

clinical findings, preoperative-intraoperative findings and surgical methods (open or laparoscopic), duration of surgery, duration of nasogastric intubation, time of return to oral feeding, length of hospital stay, and postoperative complications.

The study included those patients in the age group of 0–18 on whom laparoscopic or open surgical repairs were performed for peptic ulcer perforation in the pediatric surgery clinic. Those patients who received a PUP diagnosis between the dates above but who had malignities or general medical condition issues, as well as those whose records could not be accessed, were excluded from the study.

3.1. Statistical Analysis. Mean, standard deviation, median lowest, highest, frequency, and ratio values were used in the descriptive statistics of the data. The distribution of the variables was measured by the Kolmogorov–Smirnov test. *t*-test and Mann–Whitney *U* test were used to analyse independent quantitative data. The Chi-squared test was used in the analysis of independent qualitative data, which was replaced by the Fisher's test when the Chi-squared test conditions were not met. SPSS 27.0 software was used in the study. The analysis was done in SPSS software (version 22.0, IBM, Armonk, NY, USA). The statistical significance rate was taken as $p < 0.05$.

A total of 18 patients, consisting of 15 boys and 3 girls, were included in the study. Group 1 involved 10 patients, whereas Group 2 involved 8 patients. In 5 cases, the operation was initiated by laparoscopic surgery and then converted to open surgery, and these patients were evaluated under Group 2. The mean age of the patients was 15.7 ± 1.1 (14.0–17.0) years. The mean age of the patients in Group 1 (n: 10) was 16.1 ± 1.2 years, and in Group 2, it was 15.3 ± 0.7 years (n: 8). There was no significant difference between the ages and gender distribution of the patients in the laparoscopic and open surgery groups ($p > 0.05$). Early hospital attendance was observed in 9 (90%) patients in Group 1 and 2 (25%) in Group 2. The form of attendance was significantly different between the laparoscopic and open surgery groups ($p < 0.05$). In 5 patients (27.8%), a history of carbonated drink consumption and smoking was a predisposing factor. In Group 1, the symptom onset period was 1.6 ± 1.9 days, and in Group 2, it was 6.6 ± 6.1 days. There was a significant difference between the two groups regarding symptom onset period (p: 0.007). All patients had abdominal pain. In 9 patients, abdominal pain was accompanied by bile vomiting. In the erect abdominal radiographs (AXR) of 10 (58.8%) patients, there was air under the diaphragm (Table 1). 6 patients whose erect AXRs showed no attitude under the diaphragm but who had abdominal pain and acute abdominal manifestations were given abdominal computed tomography (CT) scanning. In 4 of these patients, free air under the diaphragm was observed, whereas in 2 patients, there was free fluid around the liver and in the pelvis. These two patients with free fluid in the pelvis also had an ultrasound scan, and there was diffuse fluid in the pelvis. In 4 cases with no free air in the erect AXR, our provisional diagnosis was perforated appendicitis (Figure 1). There was intra-abdominal free fluid in the ultrasound scan of 2 and CT scan of 2 of these 4 cases. In 15 points, the surgical procedure was initiated by laparoscopy. However, in 5 patients, it was converted to open surgery. In 3 cases, the process was directly initiated as open surgery, and the repair was completed accordingly (Figure 2). In all patients with PUP, laparoscopic/open surgery involves primary suturing and repair by omentoplasty (Graham patch). The perforated area was the antrum in 14 cases, the duodenum in 3 points, and the fundus in 1 patient.

The mean operative time was 87.0 ± 26.3 minutes in Group 1 and 122.5 ± 57.6 minutes in Group 2. There was no significant difference between the two groups regarding operative time ($p > 0.05$). The mean length of hospital stay was 3.9 ± 1.3 days in Group 1 and 5.8 ± 2.1 days in Group 2. There was a significant difference between the two groups regarding the mean length of stay (p: 0.031). The mean oral feeding start time was 2.3 ± 0.5 days in Group 1 and 2.5 ± 0.9 days in Group 2. The mean nasogastric (NG) removal time was 1.7 ± 0.5 days in Group 1 and 1.8 ± 0.7 days in Group 2. In the laparoscopic and open surgery groups, the oral feeding days and the NG removal times did not significantly differ ($p > 0.05$). In Group 1, the mean CRP value was 10.4 ± 18.4 mg/dl, and in Group 2, it was 108.1 ± 81.1 mg/dl. In the open surgery group, the CRP value was significantly higher than that in the laparoscopic group (p: 0.039). Neither group developed any major surgical complications. One patient whose operation was initiated by laparoscopy and converted to open surgery developed a local surgical site infection (Table 1). Postoperatively, all patients started taking acid-suppression medication and were referred to gastroenterological follow-up. In the endoscopic examination of 1 patient in whom the surgical procedure was converted from laparoscopy to open surgery, *H. pylori* was detected, upon which the respective treatment was initiated.

Using the Kolmogorov–Smirnov test, it is helpful to quantify if a sample is representative of the population, where n (i) is the number of points that are lower in value than Yi; the Yi are arranged from least to most significant. When two samples are compared statistically, a t-test is used. A null hypothesis that the difference in group means is zero and an alternative view that the difference in group means is different from zero is employed in hypothesis testing. The dependent variable is compared between two groups using the Mann–Whitney U test to see whether there is a difference. When comparing two groups, it checks to see whether their distributions of the dependent variable are consistent. For comparisons between observed and predicted outcomes, Chi-squared tests may be utilised. A mismatch between actual data and predicted data might be caused by chance or by a link between the variables we are researching.

4. Discussion

In pediatric age groups, PUD diagnosis has become more familiar with the start of endoscopic examination. The development of H2 blockers, proton pump inhibitors (PPI), and combination treatment for eradicating *H. pylori*

Table 1: Demographic, clinical, and operative findings of the patients.

		Laparoscopic		Open surgery		p	
		Mean ± SD (n%)	Median	Mean ± SD (n%)	Median		
Age		16.1 ± 1.2	16.5	15.3 ± 0.7	15.0	0.059	m
Gender	Boy	9 (90.0%)		6 (75.0%)		0.559	X^2
	Girl	1 (10.0%)		2 (25.0%)			
Form of attendance	Early	9 (90.0%)		2 (25.0%)		**0.005**	X^2
	Late	1 (10.0%)		6 (75.0%)			
History		1 (10.0%)		3 (37.5%)		0.275	X^2
Abdominal pain		10 (100.0%)		8 (100.0%)		1.000	X^2
Vomiting		5 (50.0%)		4 (50.0%)		1.000	X^2
Symptom start time (day)		1.6 ± 1.9	1.0	6.6 ± 6.1	4.5	**0.007**	m
Examination	Acute abdomen	7 (70.0%)		7 (87.5%)		0.588	X^2
	Epigastric guarding	3 (30.0%)		1 (12.5%)			
Predisposing factor	Yes	2 (20.0%)		3 (37.5%)		0.410	X^2
	No	8 (80.0%)		5 (62.5%)			
Erect AXR free air	Yes	4 (44.4%)		6 (75.0%)		0.335	X^2
	No	6 (66.7%)		2 (25.0%)			
Ultrasound	Yes	5 (50.0%)		2 (25.0%)		0.367	X^2
	No	5 (50.0%)		6 (75.0%)			
CT	Yes	6 (60.0%)		3 (37.5%)		0.343	X^2
	No	4 (40.0%)		5 (62.5%)			
Drain	Yes	6 (60.0%)		6 (75.0%)		0.502	X^2
	No	4 (40.0%)		2 (25.0%)			
Oral feeding day		2.3 ± 0.5	2.0	2.5 ± 0.9	2.5	0.550	m
NG removal (day)		1.7 ± 0.5	2.0	1.8 ± 0.7	2.0	0.959	m
Drain removal (day)		2.8 ± 0.4	3.0	3.0 ± 0.9	3.0	0.718	m
WBC ($\times 10^3$)		13.4 ± 3.9	13.0	13.7 ± 4.9	14.1	0.879	t
CRP		10.4 ± 18.4	2.5	108.1 ± 81.1	120.5	**0.039**	m
Operative time (min)		87.0 ± 26.3	82.5	122.5 ± 57.6	112.5	0.100	t
Perforated area	Prepyloric	7 (70.0%)		3 (37.5%)		0.342	X^2
	Antrum	1 (10.0%)		3 (37.5%)		0.274	X^2
	Duodenum	1 (10.0%)		2 (25.0%)		0.558	X^2
	Fundus	1 (10.0%)		0 (0.0%)		1.000	X^2
Length of stay (day)		3.9 ± 1.3	3.5	5.8 ± 2.1	6.0	**0.031**	m

t: independent sample t-test, m: Mann–Whitney u test, and X^2: chi-squared test (Fisher's test).

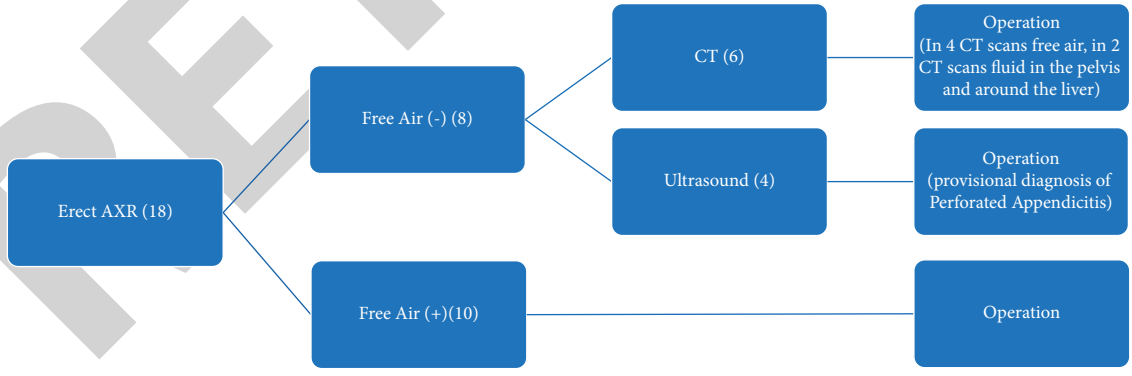

Figure 1: Diagnosis methods.

infection has rendered peptic ulcer treatment largely conservative [1–8, 14–24]. In the adult population, PUP has been reported in around 10% of PUD patients [25]. Although PUP is a well-known pathology in adults, there is insufficient knowledge about this condition in the pediatric population [3].

According to the information obtained from a limited number of studies, PUP is more common in adolescents and males [3, 19, 22]. In a study by Carol et al., 14.9 years of mean age and prevalence of male gender were found [12]. Our study was also in harmony with the literature in that the mean age was 15.8 ± 1.014 years, and 80% of our cases were males. In adult PUP patients, an underlying predisposing factor is often determined [4–8], whereas in children, predisposing elements could be selected at around 20% [11]. In 5 of our patients (27.8%), more frequent smoking and

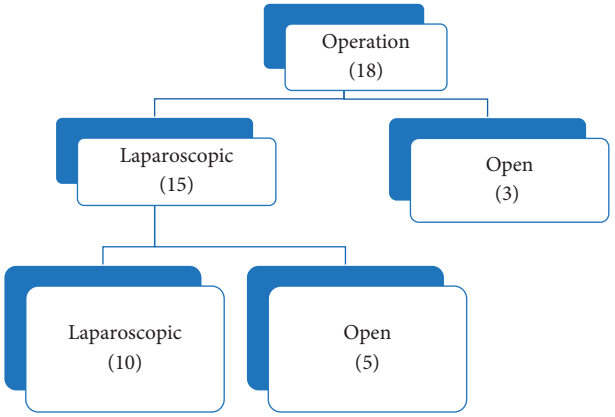

Figure 2: Surgical methods.

alcohol consumption were detected as predisposing factors. Yet, it is necessary to consider PUP in children with predisposing history based on lifestyle changes in adolescence (uptake of smoking or consuming alcohol, etc.). Further, since this age group may hide the history of alcohol consumption and tobacco from the family, the past should be obtained in more detail.

A study reported acute abdominal pain in the entirety of 52 patients and peritonitis findings in 49 patients. It was indicated that in adolescents attending for acute abdominal pain who also have peritoneal results, PUP should be suspected [3]. In a study on 13 patients, Carol et al. indicated that all patients attended the emergency unit for acute abdominal pain, and none were previously followed up for PUD [12]. In our study, abdominal pain and vomiting were significant symptoms. All patients had abdominal pain, and 61.1% had abdominal pain for one day or shorter. None of the patients had identified peptic ulcer symptoms or received treatment for it. We consider that PUP should always be kept in mind in adolescent children who attend for acute abdominal pain because PUP is less frequent in childhood.

In the study of Man-Chin et al., subdiaphragmatic free air was detected in the erect AXR of 43 patients (82.7%). The remaining nine patients without subdiaphragmatic free air were given laparotomy upon indirect bowel perforation findings, such as abdominal computed tomography or acid in ultrasound or the physical evidence of the peritoneal conclusions [3]. In the study of Carol et al., the rate of air under the diaphragm was 38.5% [12]. In 2 cases (15%) in whose erect AXR no free air was found, free air was detected by CT. In our study, ten patients (58.8%) had free air under the diaphragm in erect AXRs. 7 out of the ten patients who had free air under the diaphragm were operated on without ordering additional imaging methods. Three of these ten patients had been given an abdominal CT in addition to erect AXR in the centre they were referred to. We think that additional imaging will not be necessary if there is free air under the diaphragm in cases evaluated in combination with clinical findings. 4 out of the eight patients who had no free air under the diaphragm in the erect AXRs were diagnosed upon finding intra-abdominal free air in the abdominal CT scans. The other 4 cases were operated on for the provisional diagnosis of perforated appendicitis, but instead, PUP was encountered. In 2 of these cases, abdominal ultrasound reported diffuse fluid in the pelvis. We recommend CT instead of ultrasound in cases whose erect AXRs do not show free air to eliminate PUP diagnosis in adolescent patients who describe acute and severe pain in their history. Still, the laboratory values of whom do not conform to perforated appendicitis.

In 5 of 13 cases, Carol et al. decided on surgical procedures based on preoperative app diagnosis. Therefore, they emphasized that alternative imaging techniques are necessary for patients suspected of PUP due to clinical findings despite the lack of air under the diaphragm [12]. In our study, in 2 of the cases operated for the provisional diagnosis of perforated appendicitis, diffuse intra-abdominal fluid had been reported in the preoperative ultrasound imaging. An erroneous provisional diagnosis of perforated appendicitis by ultrasound enhances the diagnostic importance of CT in PUP cases. We believe that ultrasound is not a promising imaging method in PUP diagnosis. Thus, CT should be the primary diagnostic examination method in adolescent children having suspicious abdominal findings due to the probability of PUP.

The current approach to well-defined PUP treatment in adults is laparoscopic repair and somnoplasty [6, 20]. They are performed safely, efficiently, and rapidly. However, there is no sufficient accumulation of knowledge about laparoscopic surgery in PUP treatment in the pediatric period, and it is at the level of case reporting [10, 26]. Most childhood cases are treated by laparotomy [7, 18]. In a study by Man-Chin et al., only 1 out of 52 points was given a laparoscopic procedure [3]. They indicated that laparoscopic treatment might be a good choice for PUP. In another study, 17 patients with perforated peptic ulcers were operated on by laparoscopy. And 13 cases were repaired by laparoscopy. Conversion from laparoscopy to open surgery was performed on 2 points for technical difficulties and two other issues for the large size of the ulcer (23.5%) [26]. In the literature, the conversion rate is reported as 0–23.5%, irrespective of hospital attendance time (2, 25, and 26). In our study, laparoscopy was performed on 15 patients. 10 (55.6%) cases were repaired by laparoscopy. In our series, 5 points were converted from laparoscopy to open surgery (27.8%). The main reasons for conversion to open surgery were surgical experience and dirty and adhesive abdomen due to late attendance, rendering the manipulation of laparoscopy difficult. Although laparoscopic expertise is limited in childhood PUP, we advocate that laparoscopy can be safely used in PUP. Further, an additional advantage of laparoscopy is that in cases initiated for perforated appendicitis, a PUP diagnosis can be easily made, and PUP repair may be performed without changing port entry sites. Thus, in 3 out of the 4 cases operated for the provisional diagnosis of perforated appendicitis, the repair was made by laparoscopy without placing additional ports.

The hospital attendance and symptom onset time were significantly higher in the open surgery group than in the laparoscopic group. Therefore, we consider that the need for open surgery increases because in available surgery cases, symptom onset and hospital attendance times are late, which

causes prevalent gastrointestinal content in the abdomen leading to inflammation and intestinal adhesion that render laparoscopic manipulation difficult. In other words, as the symptom time is extended, the need for open surgery increases. Regarding immediate open surgery, we maintain that surgical experience plays an important role. Thus, in 2 out of the 3 cases directly operated by open surgery, the mean hospital attendance time was one day or shorter. Yet, irrespective of symptom onset time, we believe that initially, laparoscopy should be attempted in cases suspected of PUP despite limited experience. Therefore, in patients that have no air under the diaphragm but clinically manifest acute abdominal symptoms, we believe that initiating surgery by laparoscopy will enable better identification of the pathology, hence preventing unnecessary and erroneous abdominal incisions.

In a study by Helena et al. [21], the mean duration of laparoscopic surgery was found as 78.6 minutes. Again, the study of Carol et al. found the operative length of those cases finalized by laparoscopy to be higher than that of those who underwent open surgery. Yet, the difference was not statistically significant [12]. Our study also found that although in the cases operated under open surgery, the surgery period was slightly longer, there was no significant difference between the operative length of laparoscopic and open surgery groups. We believe that the longer duration of open surgery results from surgical manipulation in such cases being more difficult as these cases may have become complicated due to their symptom period and late attendance time. Again, in this group, the duration of the laparoscopic surgery performed before conversion to open surgery was included in the overall operative time. The laparoscopic surgery length in our study conformed with the literature [21]. We attribute shorter laparoscopic duration to our clinical experience in laparoscopy. In the laparoscopic surgery group, there are fewer GIS contents and bowel contact and intestinal adhesions due to shorter hospital attendance time and symptom onset time. We consider that early hospital attendance positively affects surgical length. Untreated PPU may lead to life-threatening perforated ulcers, necessitating immediate surgical intervention. Open surgery was used to treat all but one patient, who was laparoscopically treated. Laparotomy is the treatment of choice for PPU patients. Laparoscopy is used to treat all children with PPU.

In the study of Man-Chin et al., it was reported that nine patients (17.3%) developed complications postoperatively. The most frequently encountered complication was surgical site infection. In another study, it was emphasized that symptom periods longer than 12 hours increased the postoperative complication rate. It was indicated that surgical delay had a higher probability of rendering patients susceptible to complications [3]. Neither group developed any major surgical complications in our study. One patient whose operation was initiated by laparoscopy and converted to open surgery developed a local surgical site infection. This shows that more extended symptom periods may increase complication rates.

According to the World Society of Emergency Surgery Guidelines published in 2020, mortality rates are high in patients who are hemodynamically unstable and have severe cardiovascular and pulmonary comorbidity. Hence, it is indicated that laparoscopy is not suitable for such patients [27]. Man-Chin et al. reported that two patients died among the children with PUP who were given open surgery, finding the mortality rate as 3.8%. They stated that patients with PUP had no severe conditions such as cardiovascular, pulmonary, renal, or metabolic diseases. Thus, the mortality rate was lower than that of adults [3]. There was no mortality in our study, which was harmonious with the literature. Comorbidity is extremely rare in the pediatric population. As a result, laparoscopy may be safely used in all patients irrespective of symptom onset period. Further, developing novel therapeutic measures for PUD, such as proton pump inhibitors, decreases recurrent PUD and postoperative morbidity and mortality rates [28].

In a series of 5 cases on which laparoscopy was performed, the length of hospital stay was 12 days. Carol et al. found the mean length of stay as 6.4 days in the laparoscopic patients and 10.3 days in the open surgery group. They attributed this to the fact that based on the smaller perforated area in the laparoscopic group of patients, more minor complications occurred due to less contact of the abdomen with the gastrointestinal contents [12, 21]. In our study, the length of hospital stay was shorter in the laparoscopic and open surgery cases than in the periods indicated in the literature. However, the size of stay was more significant in the open surgery group than in the laparoscopic group. We consider the reason as earlier hospital attendance time and shorter symptom time in those cases operated by laparoscopy. Further, we maintain that in open surgery cases, the surgical wound healing period is long, and bowel movements have a delayed return to normal due to contact with GIS contents of the intestinal lenses for a longer time. Another significant finding in our study is that a prolonged symptom time leads to an extended length of hospital stay and an increase in the need for open surgery. This information is restricted by the limited number of patients and symptom period being a subjective value. However, studies performed on adults with more cases support this finding [13, 29].

5. Conclusion

PUP is a very uncommon condition that may bring on severe stomach discomfort in children. In situations when PUP may be a possibility, it is critical to request and thoroughly investigate an erect AXR, which is a straightforward and low-cost procedure. Because ultrasound has the potential to lead to diagnostic errors, it is essential to keep in mind that an erect AXR may not always show free air. In patients whose medical history and clinical findings are consistent with peptic ulcer perforation, CT should be preferred over ultrasound for establishing the diagnosis. In cases of pediatric PUP, the laparoscopic approach should be the first choice because of its low comorbidity, rare contraindications, more accessible exploration in comparison to the open technique, ability to continue the operation in the event of a misdiagnosis, shorter operative time, less postoperative pain,

and successful treatment results. Despite this, the laparoscopic technique may cause damage to internal tissues, such as the vascular system and the digestive system, both of which can ultimately result in a severe ulcer. If we try to fix such concerns by performing a gastrectomy on the problem, our study will yield the best level of efficacy.

Data Availability

The datasets generated and analyzed during the current study are not publicly available because of the university's policy but are available from the corresponding author upon reasonable request.

Ethical Approval

All procedures performed in studies involving human participants followed the ethical standards of the institutional and national research committee and the 1964 Declaration of Helsinki, and ethical approval was taken from both local ethics committees (date: 11.11.2020 and no. 1635).

Consent

Informed consent to collect and consult clinical records was obtained from all patients included in the studies.

Conflicts of Interest

The authors declare that there are no conflicts of interest regarding the publication of this article.

Authors' Contributions

MD designed the study, collected data, and was responsible for final approval of the version. AU reviewed and edited the written material. MA contributed to analysis and interpretation of data. NY revised the manuscript critically. DG was responsible for organizing data and building research questionnaires. EY collected data. All authors have read and approved the final manuscript.

References

[1] Y. W. Lee, W. C. Chung, H. J. Sung et al., "Current status and clinical impact of pediatric endoscopy in Korea," *Korean Journal of Gastroenterology*, vol. 64, no. 6, pp. 333–339, 2014.

[2] T. E. Madiba, R. Nair, T. V. Mulaudzi, and S. R. Thomson, "Perforated gastric ulcer—reappraisal of surgical options," *South African Journal of Surgery*, vol. 43, no. 3, pp. 58–60, 2005.

[3] H. Man-Chin, M. S. Kong, M.-W. Lai, and C. C. Luo, "Perforated peptic ulcer in children: a 20-year experience," *Journal of Pediatric Gastroenterology and Nutrition*, vol. 45, no. 1, pp. 71–74, 2007.

[4] N. Kalach, P. Bontems, S. Koletzko et al., "Frequency and risk factors of gastric and duodenal ulcers or ero- sions in children: a prospective 1-month European mul- ticenter study," *European Journal of Gastroenterology and Hepatology*, vol. 22, no. 10, pp. 1174–1181, 2010.

[5] J. E. Dowd, R. Cimaz, and C. W. Fink, "Nonsteroidal anti-inflammatory drug-induced gastroduodenal injury in children," *Arthritis & Rheumatism*, vol. 38, no. 9, pp. 1225–1231, 1995.

[6] M. J. Edwards, S. J. Kollenberg, M. L. Brandt et al., "Surgery for peptic ulcer disease in children in the post-histamine2-blocker era," *Journal of Pediatric Surgery*, vol. 40, no. 5, pp. 850–854, 2005.

[7] S. Goyal, A. Garg, and S. Goyal, "Peptic perforation in children: a diagnostic dilemma," *Journal of Medical Research*, vol. 3, no. 2, pp. 57–59, 2017.

[8] N. Kalach, P. Bontems, and J. Raymond, "[Particularities of ulcer disease in children]," *Archives de Pediatrie: organe officiel de la Societe francaise de pediatrie*, vol. 17, no. 6, pp. 812-813, 2010.

[9] A. S. Munoz Abraham, H. Osei, A. Martino et al., "Incidence and outcomes of perforated peptic ulcers in children: analysis of the kid's inpatient database and report of two cases treated by laparoscopic omental patch repair," *Journal of Laparoendoscopic & Advanced Surgical Techniques*, vol. 29, no. 2, pp. 248–255, 2019.

[10] K. Azarow, P. Kim, B. Shandling, and S. Ein, "A 45-year experience with surgical treatment of peptic ulcer disease in children," *Journal of Pediatric Surgery*, vol. 31, no. 6, pp. 750–753, 1996.

[11] S. Cardile, M. Martinelli, A. Barabino et al., "Italian survey on non-steroidal anti- inflammatory drugs and gastrointestinal bleeding in children," *World Journal of Gastroenterology*, vol. 22, no. 5, pp. 1877–1883, 2016.

[12] W. Y. W. Carol, P. H. Y. Chung, P. K. Tam, and K. K. Y. Wong, "Laparoscopic versus open operation for perforated peptic ulcer in pediatric patients: a 10-year experience," *Journal of Pediatric Surgery*, vol. 50, no. 12, pp. 2038–2040, 2015.

[13] K. T. Chung and V. G. Shelat, "Perforated peptic ulcer—an update," *World Journal of Gastrointestinal Surgery*, vol. 9, no. 1, pp. 1–12, 2017 Jan 27.

[14] J. G. Coghlan, H. Humphries, C. Dooley et al., "Campylobacter pylori and recurrence of duodenal ulcers—a 12-month follow-up study," *Lancet*, vol. 330, no. 8568, pp. 1109–1111, 1987.

[15] A. Dadfar and T. H. Edna, "Epidemiology of perforating peptic ulcer: a population-based retrospective study over 40 years," *World Journal of Gastroenterology*, vol. 26, no. 35, pp. 5302–5313, 2020.

[16] P. Mouret, Y. Francois, J. Vignal, X. Bartht, and R. Lombard-Platet, "Laparoscopic treatment of perforated peptic ulcer," *British Journal of Surgery*, vol. 77, no. 9, p. 1006, 2005.

[17] L. K. Nathanson, D. W. Easter, and A. Cuschieri, "Laparoscopic repair/peritoneal toilet of perforated duodenal ulcer," *Surgical Endoscopy*, vol. 4, no. 4, pp. 232-233, 1990.

[18] O. Ndour, J. Bansouda, A. F. Fall et al., "[Peritonitis following gastroduodenal ulcer perforation disease in children: report of 4 cases]," *Archives de Pediatrie: organe officiel de la Societe francaise de pediatrie*, vol. 19, no. 10, pp. 1065–1069, 2012.

[19] V. O. Nevmerzhytskyi, "Early and late complications after gastric bypass: a literature review," *General Surgery*, no. 1, pp. 60–66, 2021.

[20] C. Noguiera, A. S. Silva, J. N. Santos et al., "Perforated peptic ulcer: main factors of morbidity and mortality," *World Journal of Surgery*, vol. 27, no. 7, pp. 782–787, 2003.

[21] R. Helena, M. Dassonville, and H. Steyaert, "Laparoscopic repair for perforated peptic ulcer in children," *European Journal of Pediatric Surgery*, vol. 27, no. 3, pp. 251–254, 2017.

[22] W. T. Siu, C. H. Chau, B. K. B. Law, C. N. Tang, P. Y. Ha, and M. K. W. Li, "Routine use of laparoscopic repair for perforated

Hindawi
Journal of Environmental and Public Health
Volume 2023, Article ID 9847034, 1 page
https://doi.org/10.1155/2023/9847034

Retraction

Retracted: Relationship between Economic Growth and Energy Consumption from the Perspective of Sustainable Development

Journal of Environmental and Public Health

Received 27 June 2023; Accepted 27 June 2023; Published 28 June 2023

This article has been retracted by Hindawi following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of one or more of the following indicators of systematic manipulation of the publication process:

(1) Discrepancies in scope
(2) Discrepancies in the description of the research reported
(3) Discrepancies between the availability of data and the research described
(4) Inappropriate citations
(5) Incoherent, meaningless and/or irrelevant content included in the article
(6) Peer-review manipulation

The presence of these indicators undermines our confidence in the integrity of the article's content and we cannot, therefore, vouch for its reliability. Please note that this notice is intended solely to alert readers that the content of this article is unreliable. We have not investigated whether authors were aware of or involved in the systematic manipulation of the publication process.

Wiley and Hindawi regrets that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our own Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

References

[1] L. Dai, R. Jia, and X. Wang, "Relationship between Economic Growth and Energy Consumption from the Perspective of Sustainable Development," *Journal of Environmental and Public Health*, vol. 2022, Article ID 6884273, 10 pages, 2022.

Hindawi
Journal of Environmental and Public Health
Volume 2022, Article ID 6884273, 10 pages
https://doi.org/10.1155/2022/6884273

Research Article

Relationship between Economic Growth and Energy Consumption from the Perspective of Sustainable Development

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Received 24 March 2022; Revised 7 June 2022; Accepted 13 June 2022; Published 20 July 2022

Academic Editor: Sivakumar Pandian

While promoting the economic growth, energy has also brought pollution problems to the world environment, which has gradually become a bottleneck impeding sustainable economic development. In view of the rapid evolution of urbanization and industrialization, economic growth is increasingly dependent on the energy consumption, the development of the two is difficult to coordinate, and the internal contradictions are becoming increasingly serious, which hinders the sustainable development of economic growth. This study establishes the relationship between energy consumption and economic growth according to the energy Kuznets curve and studies the future trend of China's sustainable development through the comparative analysis of the energy Kuznets curve of the United States and Germany. The results show that, at the turning point of energy consumption, China's energy economic rate is higher than that of Germany and the United States. In addition, in terms of urbanization rate and industrial structure, although China's tertiary industry has made a breakthrough, it is still lower than that of the United States and Germany, but the level of urbanization rate has made significant progress. In short, China has obvious advantages in future economic development and has a late developing advantage compared with the United States and Germany. This paper makes an empirical analysis of the relationship between energy consumption and economic growth in OECD countries and finds out the turning point of energy consumption, so as to provide a theoretical basis for coordinating China's energy consumption and economic growth.

1. Introduction

As an important material basis for the development of human society, energy is also the main driving force of economic growth. However, while energy promotes the economic growth, it also brings pollution problems to the world environment and gradually becomes the bottleneck hindering the sustainable development of the economy [1]. In view of the fact that the pace of China's modernization and urbanization is intensifying, environmental pollution has become the main problem restricting China's economic development, and the demand for energy consumption continues to increase. In view of this, realizing the coordinated development of energy consumption and economic growth and clarifying the future economic development direction of China are the main breakthroughs in building a moderately prosperous society in an all-round way [2]. In view of the Kuznets curve of energy consumption and economic growth, the contradiction between energy consumption and economic growth has become an important breakthrough direction to achieve sustainable economic development [3]. Therefore, to overcome the inherent contradiction between economic growth and energy consumption and realize the coordinated development of the two is the only way for China to solve the future economic development plan and establish a sustainable economic development path [4].

Analyzing the relationship between energy and economic development from the perspective of economics, there are mainly two aspects, first, the economic development is dependent on energy. That is, the economic development is inseparable from energy. Secondly, the degree and scale of energy opening and utilization are based on

certain economic development conditions. Economic development can promote the large-scale development and utilization of energy. In order to explore the internal relationship between China's energy consumption and economic growth, economists use a large number of measurement methods to study the statistical data from different periods. The data show that the results are very different. Energy is introduced into the Cobb Douglas production function as a new variable. A VAR model is established, and a conclusion is drawn that China's energy consumption is related to the economic growth. Because the relationship between China's power consumption and China's energy consumption and economic growth is in a complex economic system, any different initial or research methods may lead to completely different results.

In view of the relationship between energy consumption and economic growth, this study describes the energy Kuznets curve, establishes the economic turning point of energy consumption, explores the regularity of economic growth and energy consumption, and excavates the economic planning and development strategy suitable for China's sustainable development road by drawing the energy Kuznets curve and establishing the economic turning point of energy consumption. Then, by forecasting the historical data of China's energy consumption and economic growth, we find out the future turning point of China's energy consumption and finally provide strategic experience for coordinating China's energy consumption and economic growth.

The innovation of this study is that, in order to determine the inherent law of economic growth and energy consumption and to overcome the contradiction between them in the development process, this paper empirically analyzes the relationship between energy consumption and economic growth in OECD (Organization for Economic Co-operation and Development) countries and finds out the turning point of energy consumption, so as to provide a theoretical basis for coordinating China's energy consumption and economic growth. After that, it evaluates the relevant data of China's energy consumption and economic growth, constructs the energy Kuznets curve, and establishes the turning point of China's energy development in the future, and through the comparative analysis of the relevant data of the United States and Germany, the specific similarities and differences are analyzed so as to provide practical experience for promoting the road of sustainable development in China.

The main structure of the paper is divided into four parts. Firstly, the paper compares and analyzes the Kuznets curve of energy between the United States and Germany, finds out the essence of the energy turning point law, analyzes the regular content between the energy consumption and economic growth in the United States and Germany with reference to the historical data, and subdivides the relationship between the urbanization rate, industrial structure, and other related factors and the energy turning point. Secondly, it analyzes the relationship between energy consumption and economic growth in China, establishes the energy turning point, and makes a comparative analysis with the United States and Germany. Finally, according to the relationship between China's economic growth and energy consumption, we should make clear the direction of China's economic development and promote the road of sustainable development in China.

2. Related Work

Pla Julian and Guevara pointed out that, for the economic development based on sacrificing the natural ecological environment, the goal and consensus of sustainable development should be established to ensure the sustainable development of the Earth. Transforming consumption and the production processes is a fundamental priority of this development agenda. As an alternative model, the circular economy has emerged because of its potential to create a value and has positive social and environmental impacts (Pla Julian and Guevara) [5]. Eihigiamusoe and Lean used the first and the second-generation cointegration and estimation procedures to solve the different economic and econometric problems and found that there is a cointegration relationship between the variables. In the whole sample, energy consumption, economic growth and financial development have adverse effects on the carbon emissions, and energy consumption will increase the carbon emissions. The results show that the high-income level and financial development can reduce the carbon emissions, while low-income and financial development may aggravate the carbon emissions (Ehhigiamusoe and Lean) [6]. The results show that energy consumption has a positive and a significant impact on the economic growth. There is a positive correlation between the financial development and economic growth (Sadraoui et al.) [7]. According to the nonstationary time series that may appear in some provinces, the autoregressive distribution lag (ARDL) modeling method is adopted. The estimation results show that the relationship between per capita energy consumption and per capita GDP varies greatly among provinces [8]. Asumadu and Vladimir used panel data regression with the Driscoll Kraay standard error and the U test estimation method and panel quantile regression with the nonadditive fixed effect. It is found that the energy consumption has a strong positive impact on the greenhouse gas emissions (Asumadu and Vladimir) [9]. Jin and Yu pointed out that the China's total energy consumption has increased sharply, and also China's dependence on coal is relatively high. This has also brought about serious environmental problems, which will become one of the main reasons for restricting China's economic development (Jin and Yu) [10].

Using the annual data from 1980 to 2011, Deonanan and Ramkissoon studied the causal relationship between energy consumption and economic development in 13 Caribbean small island developing states. The multivariate model including the environmental emissions is estimated, and the Granger causality is tested by the Toda-Yamamoto method to determine the causality of each country. The evidence for the four different types of causality was found. These results have an impact on the various energy policies in the Caribbean economies (Deonanan and Ramkissoon) [11]. Tran et al used the system generalized moment method (SGMM)

to comprehensively estimate the three simultaneous equations of human development, energy consumption, and dioxin emissions in 90 countries from 1990 to 2014. The results showed that the improvement of human development level leads to the reduction of carbon emissions in global sample countries and developing countries. However, in developed countries, there is no significant relationship between the carbon emissions and human development (Tran et al) [12]. Mohsin et al. used the econometric method to test the relationship between economic growth and energy consumption. The research results showed that economic growth at the cost of energy consumption leads to urban environmental degradation, and it is difficult to carry out the sustainable development path (Mohsin et al) [13]. Erzi et al established a model based on the heterogeneous productivity to analyze the macroeconomic problem of energy consumption changing with the economic development when the economy becomes more productive. Studies have shown that when an economy becomes more productive, it will have more output and will input more resources, and most importantly, energy will also increase (Erzi et al) [14]. Taking nine resource-based regions in China as the research objects, Hao and Deng used the variable coefficient panel model and the Hansen panel threshold model to quantify the marginal effect and threshold effect of innovation ability in optimizing energy consumption structure. The results show that the total index of energy consumption structure in the analysis region is 0.563, indicating that the structure is relatively low, and the regional economic development mainly depends on low-grade energy (Hao and Deng) [15].

Through the relevant research on economic growth and energy consumption by many scholars at home and abroad, we can see that the regular content between the energy consumption and economic growth is analyzed, and the relationship between the urbanization rate, industrial structure, and other related factors and the energy turning point is subdivided [16]. To analyze the relationship between energy consumption and economic growth in China, it is very important to establish the energy turning point. In short, the relevant literature shows the theoretical analysis of the relationship between energy consumption and economic growth, establishes the inherent law between the two and the empirical analysis of the relationship between the energy consumption and economic growth in various countries, and finds out the turning point of energy consumption is an important theoretical basis for coordinating energy consumption and economic growth [17].

3. Empirical Analysis of Economic Development and Energy Consumption in OECD Countries

3.1. Analysis of US Energy Kuznets Curve. In view of the relationship between energy consumption and economic growth, this study describes the energy Kuznets curve, establishes the economic turning point of energy consumption, explores the regularity of economic growth and energy consumption, and excavates the economic planning and economic development suitable for China's sustainable development. Then, by forecasting the historical data of China's energy consumption and economic growth [18], we find the future turning point of China's energy consumption, and finally, it provides a strategic experience for coordinating China's energy consumption and economic growth. In view of this, this study first verifies whether there is an "inverted U" relationship between the economic growth and energy consumption in OECD countries, and then through the identification of their internal regularity and the turning point of energy consumption, the contradiction between energy consumption and economic growth can be overcome. In order to directly reflect the turning point of energy consumption [19], this study selects Germany, the United States, Australia, Canada, and the United Kingdom as the research objects and analyzes the relationship between energy consumption and economic growth of these five countries as a whole and draws up the "inverted U" curve of these five countries, as shown in Figure 1.

As can be seen from Figure 1, with the increase in per capita GDP, per capita energy consumption decreased significantly. For Germany, there will be a turning point in the trend when the per capita GDP reaches its peak. Compared with the other three countries, the per capita energy consumption of the UK and Germany is relatively stable. However, for Canada and Australia, their energy consumption fluctuates greatly, which shows that there is a significant relationship between the economic growth and energy consumption. For the United States, the per capita GDP corresponding to its energy consumption is the highest. The reason why the relationship between energy consumption and economic growth in the five countries is quite different is mainly due to the different industrial structures and economic policies of specific countries, which leads to the great difference between energy consumption and economic growth [20]. According to Figure 1, when compared with other countries, Germany has the first energy consumption turning point, followed by the United States and the United Kingdom, and Canada has a late energy consumption turning point. It was not until 2006 that Australia saw a turning point in energy consumption. In order to further analyze the relationship between energy consumption and economic growth, we explore the regularity of economic growth and energy consumption and dig out the economic planning and economic development suitable for China's sustainable development. This study also analyzes the relationship between the urbanization rate, industrial structure, per capita GDP, and energy consumption, so as to find out the important factors that affect the turning point of energy consumption. The specific results are shown in Table 1.

From Table 1, it can be concluded that the United States, Germany, the United Kingdom, and Canada reached the turning point of energy consumption in 2000. Therefore, energy consumption is an important prerequisite for economic growth. The turning point of energy consumption corresponding to unit GDP energy consumption is relatively low. The improvement of technical level can effectively improve the energy consumption rate, that is,

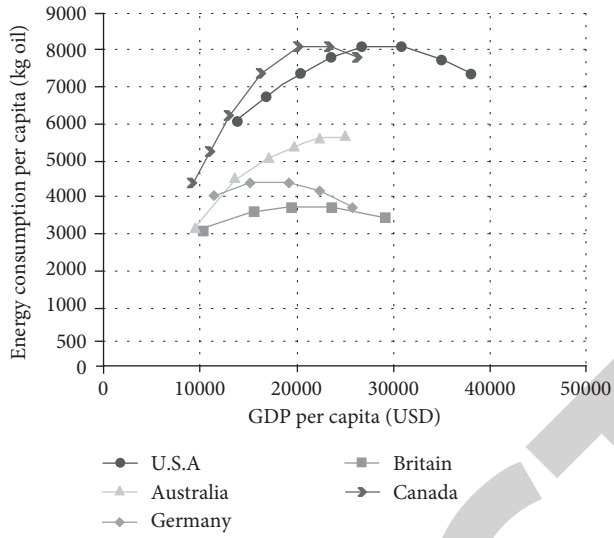

Figure 1: "Inverted U" curve fitting diagram of per capita energy consumption and per capita GDP in different countries.

Table 1: Indicators of economy, energy, and the environment when the energy consumption turning point appears.

Five OECD countries (year)	GDP per capita (USD)	Per capita energy consumption (tons)	Energy consumption per unit GDP (T/10000)	CO_2 emissions per capita (tons)	Ratio of three industrial structure (%)	Urbanization construction rate (%)
USA (1994)	29249.7	11.1	0.45	19.5	1.8 : 26.2 : 72.0	76.9
Australia (2006)	24310.7	8.0	0.40	17.9	3.1 : 28.0 : 68.9	88.4
Germany (1988)	18144.8	6.6	0.44	—	1.8 : 38.1 : 60.1	72.9
Britain (1994)	20908.1	5.3	0.31	9.6	1.7 : 30.4 : 67.9	78.3
Canada (1999)	22480.9	11.4	0.61	16.8	2.5 : 31.2 : 66.3	79.1

the improvement of technical level can strengthen the utilization rate of energy. In addition, the optimization of industrial structure can accelerate the emergence of energy consumption turning point. At the same time, the urbanization rate can also promote the emergence of the energy consumption turning point. In short, through the analysis of the relationship between energy consumption and economic growth in the United States, Germany, the United Kingdom, Canada, and Australia, the "inverted U" curve shows that there is a positive correlation between the economic growth and energy consumption, that is, the greater the energy consumption, the faster the economic growth. However, when the economy grows to a certain level, the government's attention to energy issues, the improvement of technical level, the optimization of industrial structure, and the innovation of the economic system are of great importance to the improvement of energy utilization rate, and the turning point of energy consumption appears.

3.2. Analysis of the US Energy Kuznets Curve. In the face of the relationship between energy consumption and economic growth, the US energy policy is quite typical. The state improves the utilization rate of energy consumption by formulating corresponding policies and statistical innovation, that is, coordinating the relationship between energy production and distribution and economic growth. It can be said that the United States has a comprehensive strategic plan and vision at the level of energy policy. Among them, the United States has formulated three energy policy principles, namely, the principle of a long-term comprehensive strategy, the principle of coordinated development between clean and efficient development and environmental and ecological construction, and the principle of an effective combination of per capita living standard construction and energy and environmental policies. Specifically, the industrial structure and urbanization rate of the United States are shown in Figure 2.

The primary industry refers to the industries that produce aquatic, native, and agricultural raw products, such as agriculture, forestry, and fishing. The secondary industry refers to the industries that process the raw materials of the primary industry and this industry. The common ones are mining, manufacturing, construction, and so on. The tertiary industry refers to the industries other than the primary industry and the secondary industry that are independent. The common ones are transportation, catering, real estate, and so on. It can be seen from Figure 2 that, historically, the energy consumption in the United States is mainly wood energy. After that, energy consumption has shifted from wood to coal and then from coal to oil. Until the second half of the last century, energy consumption in the United States was mainly coal, oil, and natural gas, accounting for more than 80%. With the development of the economy and technology in the United States, renewable energy appears in

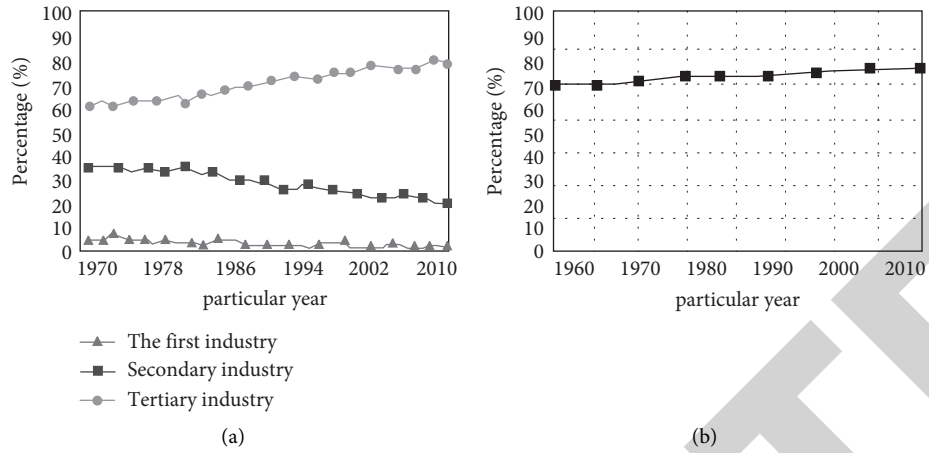

Figure 2: Industrial structure and urbanization rate in the United States. (a) American industrial structure and (b) urbanization rate in the USA.

the energy structure of the United States, and the sustainable utilization of the renewable energy effectively reduces the consumption of coal, natural gas, and oil. It can be said that the technological innovation has gradually turned the energy consumption of the United States to renewable energy and directly coordinated the relationship between the traditional energy consumption and economic growth. The changing trend of energy consumption structure and energy consumption per unit of GDP in the United States is shown in Figure 3.

According to the relevant data from the world bank, this paper compares the growth rate of per capita GDP and the growth rate of energy consumption in the United States since 1961. The results show that, with the growth or recession of the US economy, the energy consumption basically remains unchanged. In addition, the regression analysis shows that the relationship between economic growth and energy consumption is inverted U-shaped. In order to find the turning point more intuitively, the relationship between per capita energy consumption and per capita GDP in the United States is fitted into an inverted U-shaped curve. On the whole, the US economic growth and energy consumption "inverted U" curve has high stability and does not have large fluctuations. Among them, the US per capita energy consumption and per capita GDP growth rate and its "inverted U" curve are shown in Figure 4.

By analyzing the relationship between the economic growth and energy consumption in the United States, it is seen that the energy consumption is the main driving force to promote economic growth. However, while energy promotes the economic growth, it also brings pollution problems to the world environment, and it gradually becomes the main problem hindering the sustainable development of the economy. This study, through determining the inherent law of economic growth and energy consumption, it finds out the turning point of energy consumption and then overcomes the internal contradiction between energy consumption and economic growth so as to provide the theoretical basis for coordinating energy consumption and economic growth in China. As can be seen from Figure 4, with the growth or recession of the US economy, the trend of energy consumption remains basically unchanged. In addition, the regression analysis shows that, in the relationship between economic growth and energy consumption, the relationship between per capita energy consumption and per capita GDP in the United States is inverted U-shaped, and the "inverted U" curve between the economic growth and energy consumption in the United States is stable and does not have large fluctuations. On the whole, it is very important to see through the relationship between energy consumption and economic growth in the United States, to explore the regularity of the economic growth and energy consumption and to dig out the economic planning and economic development suitable for China's sustainable development.

3.3. Kuznets Curve Analysis of German Energy. By exploring the relationship between energy consumption, urbanization rate, and industrial structure, it is found that the German urbanization rate is relatively stable, but the industrial structure changes greatly. The specific results are shown in Figure 5.

Compared with other countries, Germany's economic situation is mainly characterized by developed industrialization but restricted by its own natural environment, resulting in the shortage of natural resources in Germany. In view of the positive correlation between economic growth and energy consumption, it is difficult for German industry to develop sustainably and healthily. It is necessary to optimize the energy structure and to develop new energy so as to reduce the economic development obstacles caused by its own energy defects. The historical energy consumption structure and unit energy consumption trend of Germany is shown in Figure 6.

It can be seen from Figure 6 that Germany's economic growth is stable, but the energy consumption is not stable. According to the regression analysis of the energy consumption, the relationship between per capita energy consumption and per capita GDP in Germany is fitted into an

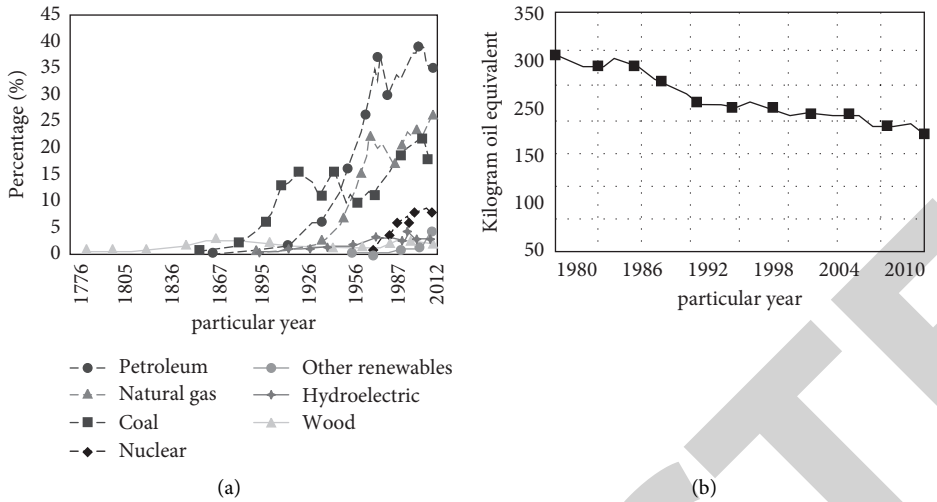

Figure 3: The trend of energy consumption structure change and energy consumption per unit GDP in the United States. (a) Energy consumption structure in the USA and (b) unit energy consumption in the USA.

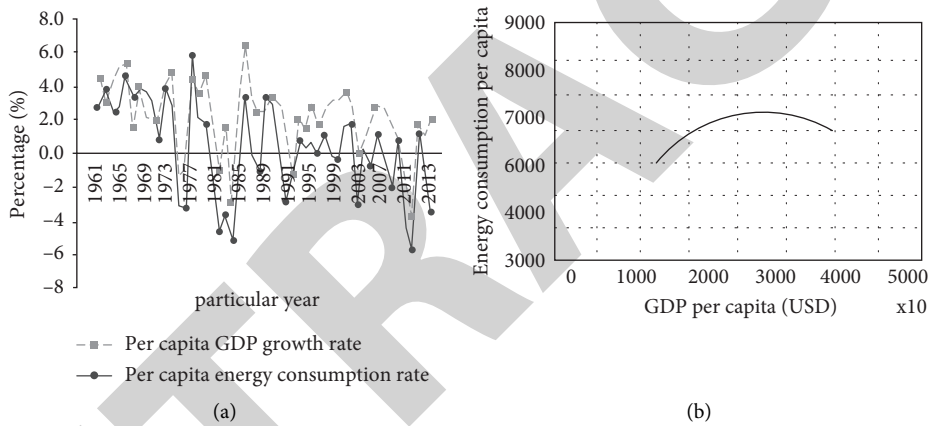

Figure 4: Comparison of per capita energy consumption and GDP growth in the United States and its "inverted U" curve. (a) Comparison of energy consumption and GDP and (b) the "inverted U" curve fitting diagram.

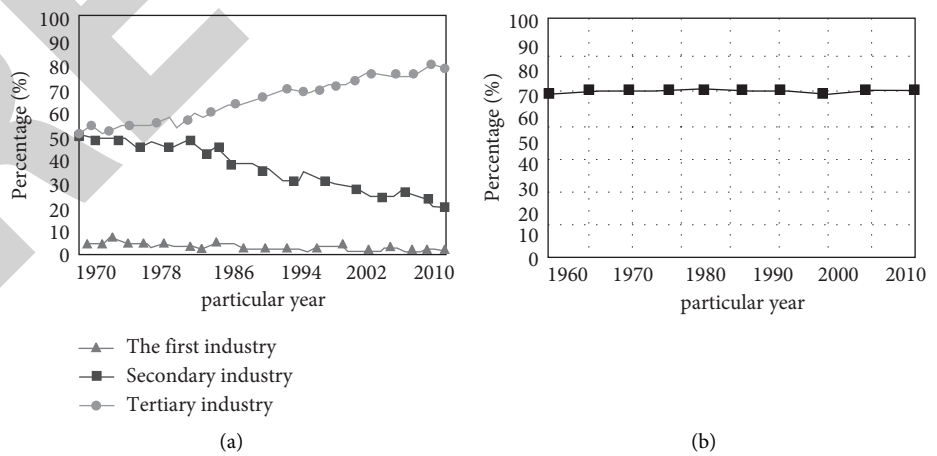

Figure 5: The trend of German industrial structure and urbanization rate. (a) Germany industrial structure and (b) urbanization rate in Germany.

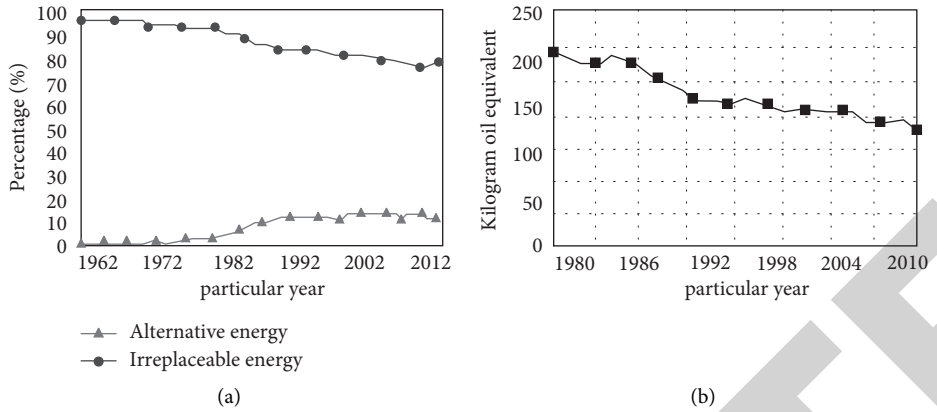

Figure 6: Historical energy consumption structure and unit energy consumption trend in Germany. (a) Energy consumption structure in Germany and (b) unit energy consumption in Germany.

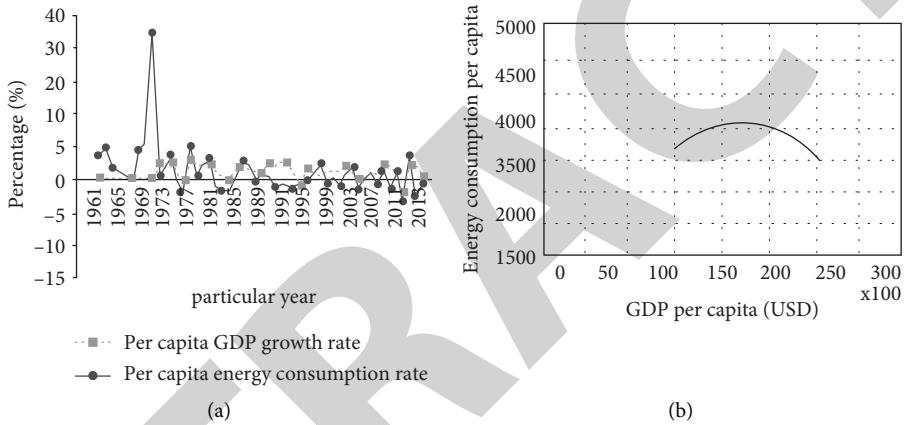

Figure 7: Comparison of per capita energy consumption and GDP growth in Germany and its "inverted U" curve. (a) Comparison of energy consumption and GDP and (b) "inverted U" curve fitting diagram.

inverted U-shaped curve. After entering the turning point, Germany's per capita energy consumption shows a significant downward trend. Among them, the Germany's per capita energy consumption and the GDP growth rate and its "inverted U" curve are shown in Figure 7.

In view of the Kuznets curve of energy consumption and economic growth, the contradiction between the energy consumption and economic growth has become an important breakthrough direction to achieve sustainable economic development. Therefore, to explore the coordinated development of the energy consumption, economic growth is the only way to solve the future economic development plan and establish a sustainable economic development path. This study establishes the relationship between energy consumption and economic growth according to the energy Kuznets curve and studies the future trend of China's sustainable development by comparing and analyzing the energy Kuznets Curves of the United States and Germany.

4. Experimental Design and Analysis

4.1. Analysis of Kuznets Curve Results of China's Energy. This study establishes the relationship between energy consumption and economic growth according to the energy Kuznets curve and studies the future trend of China's sustainable development by comparing and analyzing the energy Kuznets Curves of the United States and Germany. At a specific level, the turning point of China's energy consumption is predicted and analyzed by analyzing the historical data of the energy consumption and economic growth in China. The methods quadratic equation was used for regression analysis (Table 2).

In order to visualize the relationship between China's energy consumption and economic growth, this study makes an inverted U curve fitting between China's future energy consumption and per capita GDP. Among them, the "inverted U" curve fitting diagram of China's per capita

Table 2: Regression analysis parameters of China's per capita GDP and per capita energy consumption.

Constant α	Parameter $\beta 2$	Parameter $\beta 2$	R2	F value	Turning point
623.3669	0.333999	−9.7 E-0.6	0.898025	176.1262	17138.16

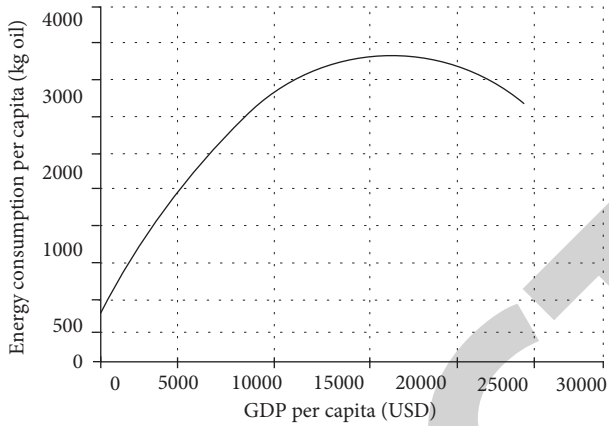

Figure 8: "Inverted U" curve fitting diagram of China's per capita GDP and per capita energy consumption.

Table 3: Forecast data of China's economic development and energy consumption in 2035.

Per capita GDP (USD)	Ratio of three industrial structures (%)	Urbanization rate (%)	Per capita energy consumption (kg ce)	GDP energy intensity (ton standard)
17138.2	4.6 : 37.2 : 58.2	72	3800	0.31

energy consumption and per capita GDP is shown in Figure 8.

It is predicted that China's per capita GDP will reach a turning point of 17138 U.S dollars in the future. According to the above data, China may reach the turning point of energy consumption around the year 2035. At this time, the relevant data on China's economic development and energy consumption are shown in Table 3.

4.2. Comparative Analysis of the Kuznets Curves of the Three Countries. Economic development is closely related to energy demand. According to the results of the above analysis, this study studies the future trend of China's sustainable development by comparing and analyzing the Kuznets Curves of the US and Germany. The "inverted U" curve fitting diagram of energy consumption and economic z-growth in the United States, Germany, and China is shown in Figure 9.

According to the prediction, by 2035, China's urbanization and industrialization will become more and more mature. The growth rate of the economic indicators has slowed down significantly, and the proportion of tertiary industry in GDP has increased significantly, which has become the main force driving the economic development. The flow of population to cities tends to slow down, and the growth rate of urbanization gradually slows down. Among them, the economic and energy-related data at the turning point of energy consumption are shown in Table 4.

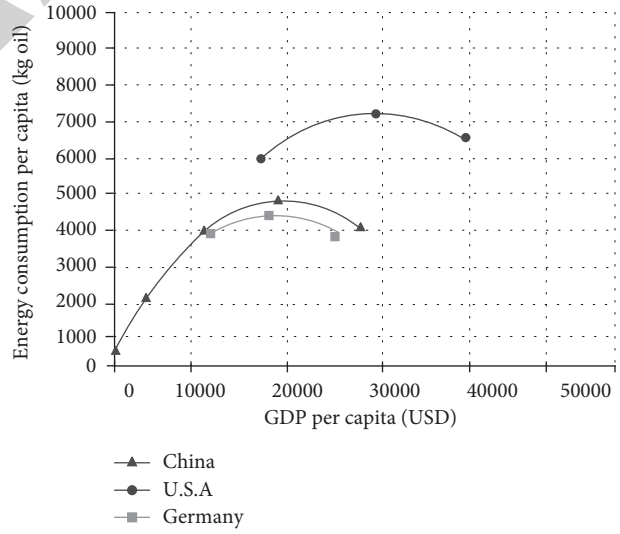

Figure 9: U-shaped curve fitting between per capita energy consumption and per capita GDP in the United States, Germany, and China.

At the turning point of energy consumption, compared with Germany and the United States, the China's energy economic rate is higher. In addition, in terms of urbanization rate and industrial structure, although China's tertiary industry has made breakthroughs, it is still lower than that of the United States and Germany, but it has made significant progress in the level of urbanization rate. In short,

Table 4: Economic and energy-related data at the turning point of energy consumption.

Country	Per capita GDP (USD)	Index: Ratio of three industrial structures (%)	Index: Urbanization rate (%)	Index: Per capita energy consumption (kg ce)	Index: GDP energy intensity (ton standard)
China	17138.2	4.6 : 37.2 : 58.2	72	3800	0.31
USA	29655.1	1.8 : 26.2 : 72.0	76.9	11.1	0.45
Germany	18144.8	1.8 : 38.1 : 60.1	72.9	6.6	0.44

China's economic development in the future has obvious advantages, compared with the United States and Germany, and has the advantages of late development.

5. Conclusion

As an important material basis for the development of human society, energy is also the main driving force of economic growth. However, while energy promotes the economic growth, it also brings pollution problems to the world environment and gradually becomes the bottleneck, hindering the sustainable development of the economy. In view of the rapid evolution of urbanization and industrialization, the dependence of the social development on energy consumption continues to increase, leading to the contradiction between economic growth and energy consumption. In view of this, how to coordinate energy consumption and economic growth has become an important breakthrough in sustainable development. This study describes the energy Kuznets curve, establishes the economic turning point of energy consumption, explores the regularity of economic growth and energy consumption, and excavates the economic planning and economic development suitable for the road of sustainable development in China. Then, by forecasting the historical data of China's energy consumption and economic growth, we find out the future turning point of China's energy consumption and finally provide strategic experience for coordinating China's energy consumption and economic growth. The results show that, at the turning point of energy consumption, China's energy economic rate is higher than that of Germany and the United States. In addition, in terms of urbanization rate and industrial structure, although China's tertiary industry has made breakthroughs, it is still lower than that of the United States and Germany, but it has made significant progress in the level of urbanization rate. In addition, it is found that China may have a turning point of energy consumption in 2035, which has a late development advantage compared with the United States and Germany. In view of the fact that China's development is bound to be constrained by high energy consumption, in order to coordinate the development of energy consumption and economic growth, this paper puts forward some suggestions, such as accelerating the strategic adjustment of industrial structure, improving the production and small consumption of energy structure and increasing the proportion of renewable energy consumption. However, there are still some problems in this paper. There is no indepth discussion on the influencing factors of the economic turning point of energy consumption, and further discussion and analysis are needed in the future research.

Data Availability

The data used to support the findings of this study are included within the article.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

References

[1] J. Ying and L. Wenbo, "Research on China's renewable energy strategic development strategy from the perspective of sustainable development," *IOP Conference Series: Earth and Environmental Science*, vol. 510, no. 3, Article ID 032026, 2020.

[2] C. Wang and J. Hong, "Empirical analysis on the sustainable development of China's outward foreign direct investment from the perspective of economic institution," *International Journal of Sustainable Development and Planning*, vol. 15, no. 3, pp. 369–375, 2020.

[3] X. Y. Du, Y. B. Guan, and T. S. Hsieh, "Research on the curriculum development of education for sustainable development (ESD) from the perspective of VR/AR assisted instruction—take guangdong business and technology university as an example," *IOP Conference Series: Earth and Environmental Science*, vol. 576, no. 1, Article ID 012019, 2020.

[4] H. Wang, M. Xin, and X. Feng, "Research on the SD simulation path of coal economic growth in China under the perspective of technological innovation," *IOP Conference Series: Earth and Environmental Science*, vol. 252, no. 5, Article ID 052045, 2019.

[5] I. Pla-Julian and S. Guevara, "Is circular economy the key to transitioning towards sustainable development? challenges from the perspective of care ethics," *Futures*, vol. 105, pp. 67–77, 2019.

[6] K. U. Ehigiamusoe and H. H. Lean, "Effects of energy consumption, economic growth, and financial development on carbon emissions: evidence from heterogeneous income groups," *Environmental Science and Pollution Research*, vol. 26, no. 22, pp. 22611–22624, 2019.

[7] T. Sadraoui, H. Hamlaoui, Z. Youness, and I. Ben Sadok, "A dynamic panel data analysis for relationship between energy consumption, financial development and economic growth," *International Journal of Econometrics and Financial Management*, vol. 7, no. 1, pp. 20–26, 2019.

[8] E. Z. Wang and C. C. Lee, "The impact of clean energy consumption on economic growth in China: is environmental

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Journal of Environmental and Public Health
Volume 2023, Article ID 9873901, 1 page
https://doi.org/10.1155/2023/9873901

Retraction

Retracted: Perception of the Impact of Artificial Intelligence in the Decision-Making Processes of Public Healthcare Professionals

Journal of Environmental and Public Health

Received 26 September 2023; Accepted 26 September 2023; Published 27 September 2023

This article has been retracted by Hindawi following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of one or more of the following indicators of systematic manipulation of the publication process:

(1) Discrepancies in scope

(2) Discrepancies in the description of the research reported

(3) Discrepancies between the availability of data and the research described

(4) Inappropriate citations

(5) Incoherent, meaningless and/or irrelevant content included in the article

(6) Peer-review manipulation

The presence of these indicators undermines our confidence in the integrity of the article's content and we cannot, therefore, vouch for its reliability. Please note that this notice is intended solely to alert readers that the content of this article is unreliable. We have not investigated whether authors were aware of or involved in the systematic manipulation of the publication process.

Wiley and Hindawi regrets that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our own Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

References

[1] Y. Saleh Ibrahim, W. Khalid Al-Azzawi, A. A. Hamad Mohamad, A. Nouri Hassan, and Z. Meraf, "Perception of the Impact of Artificial Intelligence in the Decision-Making Processes of Public Healthcare Professionals," *Journal of Environmental and Public Health*, vol. 2022, Article ID 8028275, 8 pages, 2022.

Hindawi
Journal of Environmental and Public Health
Volume 2022, Article ID 8028275, 8 pages
https://doi.org/10.1155/2022/8028275

Research Article

Perception of the Impact of Artificial Intelligence in the Decision-Making Processes of Public Healthcare Professionals

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Received 12 May 2022; Revised 24 June 2022; Accepted 27 June 2022; Published 13 July 2022

Academic Editor: Sivakumar Pandian

Technologies are increasingly independent and play important roles in society. Artificial intelligence (AI) is a branch of science that can improve various environments and processes. The health sector stands out among these contexts, especially ophthalmology and dentistry. Studies evaluating the impact of using these technologies in these contexts are still developing. There are still few studies that assess how AI can impact the decision-making process of health professionals and how it can improve the quality of care provided to these professionals. In this sense, this study aims to evaluate the perception of the impact of AI on the decision-making process of health professionals and the quality of patient care from the perspective of ophthalmologists and dentists. The methodological strategy used was the application of an online questionnaire with eighteen professionals in these areas. Based on the respondents' opinions, we sought to assess how these decision-making processes are affected by the use of technologies and how they impact the quality of patient care. As a result, it was observed that AI has become essential and a facilitator of the diagnostic processes. However, it presents some challenges related to cost, accessibility, AI x professional responsibility, and incentive of agreements.

1. Introduction

According to Khanam, et al. [1], AI is the science and engineering of creating machines that have functions performed by the brains of animals, referring to a field of knowledge associated with language and intelligence, reasoning, learning, and problem-solving. Several functions make AI so useful, such as recognizing patterns and images, understanding all types of language, perceiving relationships and connections, following decision algorithms proposed by experts, being able to understand concepts and not just process data, acquiring reasoning through the ability to integrate new experiences, and, with that, self-improvement by solving problems or performing tasks. AI processes the stored data through algorithms, improves itself through its operation, and proposes increasingly accurate diagnostic hypotheses [2].

It is clear that technological advances increasingly interfere in people's daily lives, whether facilitating existing processes or creating new methods for solving problems. Artificial intelligence (AI) is seen as a technology revolutionizing different processes in different organizational contexts [2]. The times of great technological systems are advancing faster and faster. The era of AI systems has progressed and is still progressing by leaps and bounds in diverse applications such as autonomous vehicles, autonomous planning and programming, games, and translation and even medical diagnosis can be performed through AI [3].

One of the first times that the term AI was used was in 1950, by Alan Turing, using tests to compare the

performances of man and machine [4]. In 1955, this term was used again by John McCarthy to describe AI as the science of creating intelligent machines that reproduce the behaviour of a human being. As it is something contemporary, AI can be defined in different ways, such as the great capacity of machines to perform functions that are currently performed by humans [3] or even as the creation of computing systems that work intelligently, that is without the need for human instructions.

The application of AI in the health area has been growing in several specialties, offering new and beneficial solutions to diagnose diseases [5]. AI impacts both the decision-making process of the health professional, presenting high rates of diagnostic efficiency, support for decision-making, reduced incidence of errors and improved outcomes, and the quality of patient care. In addition to AI assisting in more accurate and sensitive diagnoses, it reduces the time of disease discovery and increases physician confidence.

According to Zhang, et al. [5], publications on AI in the health area are still incipient. However, it is noted that technology can promote safety and improvements in the quality of care. One of the major discussions is whether the machine will replace a human specialist in the medical field and to what extent it will interfere with the health professional's decision-making process. It is still necessary to discuss the extent to which technological advances will improve people's quality of life, their limits, evaluation criteria, and possible benefits and challenges. In ophthalmology [6], AI programs have great potential to improve medical care for patients. Together with ophthalmologists, these technologies can contribute by showing diagnostic efficiency and remote medical evaluations in places where the specialist is not available, for example preventing the aggravation of the disease. Such AI systems work, for the most part, independently, but to do so, they must first be fed by data to generate patterns. These systems are designed to continually adapt and improve over time as they receive and train with new data input. This research focuses on two dilemmas: how can AI impact the decision-making process of healthcare professionals and the quality of patient care from the perspective of ophthalmologists and dentists?

To answer this problem, the present research aims to evaluate the perception of the impact of AI on the health professional's decision-making process and the quality of patient care from the perspective of ophthalmologists and dentists.

The specific objectives are as follows:

(i) Identify the AI technologies used by ophthalmologists and dentists;

(ii) Identify the benefits and challenges of using these technologies;

(iii) Compare the results obtained in the field of ophthalmology and dentistry.

As seen, AI can bring some benefits when used in healthcare. It can help with office organization, schedules, data, advanced diagnostics, exam optimization, and clinical data triage. It can also use complex data screening as risk factors and develop a system with predictive algorithms that can outperform humans. That is why it is so important to find out how to successfully insert AI into health processes, as there is a chance of discovering future consequences and problems to treat and/or prepare the patient for such an event. Thus, it is important to develop studies that seek to understand the impact of AI on the decision-making process of health professionals in the ophthalmic and dental areas and how this impacts patient care. In this work, a comparison of the literature with the results of the respondents will be presented concerning existing AI technologies in ophthalmology and dentistry and their benefits and challenges.

2. Methodology

The methodology concerns the ways to obtain information from an organization to be studied so that research is carried out using instruments. Through it, we seek to organize and describe how the research data in question will be collected and later evaluated and illustrate the paths whose work will be conducted [7].

2.1. Search Classification. This research is classified as descriptive. According to Gil [8], descriptive research describes the characteristics of a given population, phenomenon, or the establishment of relationships between variables. Furthermore, it is characterized by standardized data collection techniques, such as the questionnaire.

Data collection sought to relate different variables, generating thorough research on a given phenomenon without any intervention in it. There was investment and treatment of qualitative data. Although there is an inclination towards exploratory research methods, which consists of investigating a less well-known topic for familiarity with it [8], the focus was to synthesize stratified data to analyze trends within a given semantics. The approach used, as previously mentioned, was qualitative, focusing on the opinions of ophthalmologists and dentists on the impact of AI on the decision-making process and the quality of care. The defined scenario is the AI market in ophthalmology and dentistry. The context is the insertion of AI for ophthalmologists and dentists. The object, then, is not limited to AI; it also extends to professionals as subjects. As a result, it impacts the decision-making process of these professionals and the quality of care provided to the patient.

As it is an extremely current topic, several more recent articles on the topic were used, such as Zhang, et al. among others who came to add knowledge to enrich the article.

2.2. Data Collection and Organization. For data collection, a questionnaire was used that was sent through a link on Google Forms, due to the location of some respondents in addition to the pandemic itself. The responses were obtained from March 21 to April 22, 2021. It was divided into four sections. The first concerns the characterization of the respondent, evaluating the time in the profession and the type of professional care: whether it is through an agreement or

private. The second refers to the AI technologies used, whether there are incentives on the part of the agreements or the benefits and challenges of using them. The third is related to the quality of care. Finally, the fourth section evaluates decision-making issues such as the responsibility of the professional and AI and the level of trust in technologies. The complete questionnaire contains 16 questions according to Phillips-Wren and Jain [9]. The questionnaire was applied to 18 professionals from the respective areas. Of these professionals, 10 were ophthalmologists who work in the cities of Baghdad and Mosul, including in health insurance and private networks in addition to Baghdad Teaching Hospital, Iraq (BTHI). The remaining 8 were dental surgeons who work in the cities of Baghdad, Mosul, and Basrah, as shown in Table 1.

2.3. Data Analysis. Respondents' responses were manually analyzed and coded to identify the standards of the technologies used and their benefits and challenges, in addition to the impacts on decision-making processes and on the quality of care. The main form used for stratification, arrangement, and data analysis was the Microsoft Office package, mainly Word and Excel.

3. Results

This section presents the perception of professionals, ophthalmologists, and dental surgeons who answered the questionnaire regarding the impact of AI on the decision-making process of the health professional and on the quality of patient care. This section also discusses existing technologies and their benefits and perceived challenges. Below are the answers to the questionnaire, and the average of the answers given by health professionals is always used.

3.1. Existing Technologies, Benefits, and Challenges. The AI technologies used in ophthalmology were "optical coherence tomography (OCT)" and "fundus photography." In dentistry, it was the "intraoral scanner." Regarding the reported benefits, the benefit in relation to the decision-making process of physicians was emphasized. By analyzing the answers, it was found that one of the greatest benefits concerns the aid in the diagnosis, being in the increased assertiveness, the reduction of the time of detection of the disease, and presenting results that are not possible to verify in the routine examinations, the monitoring of the disease, and monitoring the evolution of her treatment. According to respondent 03.

> "[...] it reduces the time to detect the disease because if they were performed manually, they would take longer, they show us changes that are not detected in the routine exam, they help us to confirm a diagnostic suspicion, and also in the follow-up of the diagnosis. Disease and monitoring her treatment [...]."

Another reported benefit was the quality of care, allowing for a longer interaction time with the patient since the examination and detection time is optimized. The greater reliability delivered to the patient was also reported:

> "[...] with the optimization of the time of the exam, I can dedicate more time to the conversation with the patient, being conversations that help to complement the diagnosis or even about life, making the patient more comfortable and strengthening the doctor-patient relationship [...]" (Respondent 10).

> "[...] I've already noticed how some patients are more satisfied with the combination of the diagnosis that the AI offers and with my clinical examination, feeling greater reliability in the result delivered [...]" (Respondent 15).

The implementation of telemedicine was also a reported benefit, especially during the pandemic, in addition to allowing care in remote locations and helping to diagnose diseases in the initial stage. Respondent 01 reported:

> "[...] allowing telemedicine improves long-term follow-up, speed in data processing, greater flexibility of time and place to perform, making it possible to consult in remote places [...]."

Regarding the challenges, challenges related to cost, system reliability, accessibility, and IA x professional responsibility were identified. Regarding cost, it was observed that AI technologies have a high cost, making their adoption difficult by professionals. Concerning reliability, some respondents say that they do not fully trust recent technologies and expect a period for improvements. Respondent 06 states:

> "[...] usually a new technology undergoes improvements every year, especially those related to software. At first, they are not completely reliable or are not reproducible in their results. In addition to reliability, there are also financial issues, as new equipment is more expensive and not always covered by agreements or available on the public network. In some cases, the patient cannot pay for the exam, making us rethink the investment in acquiring the technology [...]."

The lack of accessibility for some is also related to the high cost of equipment. It adds little to the area of activity of these professionals, as said by respondent 02:

> "[...] OCT equipment, in which each one is entitled to one day of the week for use. That way, it became more accessible, because if not, it would not be worth the cost-benefit of acquiring this technology alone [...]."

> "[...] For my area of expertise, I still do not see the need to use AI and, depending on the case; I refer the patient only for the examination to be carried out with another professional who already has the technology [...]" (Respondent 17).

Regarding the discrepancy between the diagnoses provided by the AI vs. Specialist, respondent 13 states that:

Table 1: Characterization of the respondent.

Item/professional	Ophthalmologist	Dental surgeon
The amount	10	8
Average time of profession	16 and a half years	12 and a half years
Service provided	Carried out by agreement and private	Carried out in private

"[...] even with this difference, some studies show that the clinical diagnosis is very similar to that provided by the AI [...]."

Considering that the diagnosis may contain faults, it is important to understand those responsible for them. Thus, most respondents agree that the responsibility lies solely with the professional in the face of these diagnostic or conduct failures. The medical conduct directs to the analysis of the specialist's attitude, whether he has performed the results correctly or just acted with negligence. The AI will only be held responsible if there is evidence that the diagnosis was only possible through the examination.

"[...] The professional should not limit himself exclusively to AI data, as clinical evidence should not be neglected [...]" (Respondent 16).

"[...] The AI helps in the conduct, but the diagnosis and treatment decision is up to the specialist [...]" (Respondent 04).

"[...] Since these systems have been carried out within the quality standards, the responsibility would only be the professional [...]" (Respondent 02).

The rest stated that the responsibility could be divided: "[...] Divided, if the requested tests identify wrong diagnoses [...]" (Respondent 14).

The data presented in Table 2 refer to the percentages of variations in the common responses of ophthalmologists and dentists concerning the AI technologies used in each speciality, the benefits and challenges, and whether there is an incentive from the health plans about complementary exams that use AI.

Still on Table 2, most professionals answered that the agreement and the network do not encourage the use of complementary exams to assist in decision-making, even professionals admitting that complementary exams are useful and essential. Respondent 02 stated:

"[...] The health insurance plans and medical cooperatives guide us to try to diagnose with as few complementary exams as possible. In addition, we must follow the existing protocols for that disease so that there is no significant increase in the cost of the number of exams [...]."

3.2. Perception of the Impact of AI on Decision-Making Processes of Ophthalmologists and Dental Surgeons. As demonstrated in the literature, AI impacts the decision-making processes of health professionals. It was observed that AI complements the doctor's diagnosis. However, the clinical examination is still very important, as it is necessary to evaluate the patient's complaints and analyze the test result to confirm the diagnosis.

"[...] Medicine is patient-centred. Even if a particular exam is useful, the clinic is sovereign. Even if the device gives us a normal result, if the signs found by the clinical examination are strongly suggestive of disease, the doctor should either repeat the examination or treat the suspected disease [...]" (Respondent 06).

"[...] The exams complement each other, and, although one is normal, the other may indicate some alteration that may justify an initial disease. For example, retinal disease due to diabetes may appear normal on clinical examination, but on imaging, show internal changes that show the onset of the disease [...]" (Respondent 08).

"[...] It is also necessary to listen to the patients' complaints, being able to compare them with the evidence of the exams [...]" (Respondent 11).

Despite the high level of confidence in the diagnosis offered by AI, attention was paid to the reliability of the result without a clinical examination, as stated by respondent 09:

"[...] keep in mind that the exams still suffer from some interference and we have to take this into account before accepting a diagnosis made by the device [...]."

In addition to reliability, most also agree on the greater credibility of the diagnosis together with AI for the patient:

"[...] In ophthalmology we are very dependent on images to help in the diagnosis, but a good amanese, conversation with the patient, is capable of to lead us to the diagnostic suspicion, when done well and calmly [...]" (Respondent 08).

"[...] I believe it is an additional resource to assist in the diagnosis and give more credibility to the patient. The positive reaction of some patients is noticeable when they see the result presented by technology, together with our explanation [...]" (Respondent 18).

Even with AI aiding in the diagnosis, most healthcare professionals believe that the patient cannot define the diagnosis with AI alone.

"[...] It is always necessary to have a professional to evaluate and close the diagnosis with all the complementary exams and clinical evaluations [...]" (Respondent 15).

Table 2: Existing technologies, benefits and challenges.

Item/ Professional	Classification	Ophthalmologist	Dental surgeon
AI technologies used	Existing technologies	90% of professionals use, among them OCT and fundus photography.	60% of dentists use the intraoral scanner.
Benefits	Decision-making process; telemedicine; quality in service.	80% say AI helps with a more accurate diagnosis. 30% believe that it reduces the time of disease detection and 10% see the possibility of telemedicine as a benefit.	87.5% say that the use of AI contributes to a more accurate and assertive diagnosis. 50% say it helps in planning and predicting treatment.
Challenges	Reliability; cost; accessibility; liability AI x professional.	30% no longer used ram due to low reliability in using recent technologies; 50% due to high cost; 20% because it adds little in the area of activity; 30% lack of accessibility; 70% believe that there may be a discrepancy between the AI diagnosis and the clinical one, as in some cases it is only possible to identify the disease through AI imaging tests; 100% agree that the interpretation and guidance of the correct treatment is the health professional's role; 60% of the respondents stated that in case of diagnostic errors, the responsibility lies solely with the professional, and the other 40% claim that the responsibility should be shared.	75% no longer used AI due to the high cost, 12.5% because of the difficulty of using it in children, and 12.5% because they preferred a clinical examination. 62.5% said there might be discrepancies between diagnoses; 100% agree that the professional is fully responsible for the diagnosis as it legitimizes the most appropriate diagnosis and treatment; 75% agree that the professional is responsible for the error. The other 25% say it could be shared with AI.
Incentive agreements	Incentive to use	90% are not encouraged.	100% are not encouraged

"[...] The patient can identify the disease through the test result and applications, for example, but searching for a specialist to confirm the diagnosis and continue the treatment is essential to avoid the risk of a misdiagnosis [...]" (Respondent 10).

The percentages of responses organized in Table 3 relate to the impacts caused on decision-making processes by AI.

3.3. Perception of the Impact of AI on the Quality of Patient Care. In addition to the impact of AI on healthcare professionals' decision-making processes, it also impacts the quality of patient care. Through the answers to the questionnaire, as in the literature, it was noticed that AI impacts the aspects of interoperability, quality, and safety. Regarding interoperability, there is an increase in the time in the doctor-patient, either to talk or to go deeper into the complaints, as the time to perform the exam itself with the AI decreases, as mentioned by respondent 01:

"[...] effective and comfortable both for us and for the patient [...]", and also by respondent 08: "[...] the examination and diagnosis is performed faster than without the use of AI, allowing for a longer time of anamnesis and conversation with the patient [...]." Some of the respondents did not agree with the increase in the time of this relationship with the following explanation: "[...] the time decreases due to a more accurate diagnosis, providing more security to the patient, without the need for excessive examinations and returns[.. .]" (Respondent 09).

As for quality and safety, there is a transformation of the patient's experience, in which 100% of the respondents stated that the use of AI transformed this experience for the better:

"[...] in remote places without the presence of a specialist doctor, who may be assisted by a general practitioner, as the interpretation of the problem is facilitated [...]" (Respondent 03). The following are more positive opinions regarding this transformation: "[...] Greater security in the diagnosis, in addition to offering more agility [...]" (Respondent 05), "[...] You can feel better evaluated and help with treatment adherence [...]" (Respondent 13) and "[...] Patients can visualize and understand what is not tangible, in addition to having a prediction of results [...]" (Respondent 18).

The data available in Table 4 are about the impact of AI on the quality of patient care.

4. Discussion

This section was structured based on the research pillars: technologies explored by the two areas of health, the benefits and challenges experienced by professionals about the implementation of technologies, in addition to the perception of professionals about the impact of AI on the process of decision-making and the quality of care.

4.1. Existing Technologies. The literature shows that the existing technologies in ophthalmology are: Fundus photography and Optical Coherence Tomography (OCT) [10].

Table 3: Impact on decision-making processes by AI.

Classification		Ophthalmologist	Dental surgeon
Diagnostic aid	AI replaces or complements the diagnosis.	100% believe they should be correlated and complementary.	100% of respondents agree on the association between AI and the clinical method.
	Confidence level in the diagnosis offered by the system.	70% reported having a high level of confidence. 50% of these relate this confidence level to the patient's health condition.	100% of respondents trust the diagnosis offered by AI. In this parameter, 50% believe that the patient's health does not interfere with the confidence level, and the other half think it is important to assess the patient's general health status.
Assistance in doctor-patient interaction	Health diagnosis by the patient himself from AI.	80% do not believe that the patient can define his diagnosis with AI.	100% do not believe that with only the use of AI, the patient can define the diagnosis.
	Credibility in diagnosis through AI.	100% believe that credibility increases with the use of AI.	87.5% believe so, being an additional resource to aid the diagnosis, while 12.5% say that yes in most cases.

Table 4: Impact on the quality of care by AI.

Classification	Subclassification	Ophthalmologist	Dental surgeon
Interoperability	Increased time in the doctor-patient relationship.	80% of ophthalmologists stated that AI allows more time in this relationship, 10% said that the time of interactions is reduced, while the other 10% say that it does not necessarily change the time.	90% believe they allow more time in the doctor-patient relationship. 10% already say that the time is shorter and that the patient is loyal.
Quality/Safety	Transforming the experience of the patient.	100% of ophthalmologists stated that AI transforms the patient experience for the better.	100% stated that AI makes treatment faster and more comfortable.

The survey results show that 90% of ophthalmologists who participated in the survey use these technologies and the other 10% say they still do not use any. In the field of dentistry, the literature addresses the technologies, namely confocal laser endomicroscopy, CAD/CAM technology, and intraoral scanner, however, it was observed that only the intraoral scanner technology is used by 60% of the respondents. As demonstrated in the literature, AI technologies in these two healthcare areas are very focused on helping diagnosis rather than treatment.

4.2. Benefits. The literature identifies 3 benefits of using AI: (1) decision-making process, (2) quality of service, and (3) telemedicine. Respondent's judge the 3, and the most commented was in relation to support for the decision of the diagnosis, being in the increase of assertiveness, in the reduction of the time of detection of the disease, and in the follow-up of it [11].

The quality of care was also presented as a positive point since the use of technologies increased the length of the doctor-patient relationship. Greater patient satisfaction was also observed with the combination of the diagnosis offered by the AI and the health professional, as they claim greater reliability in the diagnosis presented. As for telemedicine, professionals justify its importance insofar as it allows care in remote locations, helping in an early diagnosis of any disease that could quickly worsen without any action.

4.3. Challenges. The literature presents 4 challenges with the use of AI: (1) interaction with the patient, (2) cost, (3) AI x professional responsibility, and (4) reliability. In the questionnaire results, the 4 classifications of the challenges were observed, but with some extra information not mentioned in the literature, such as the issue of support from the agreements. In ophthalmology, many doctors are insured, but the insurance companies ask professionals to carry out diagnoses with the least number of exams due to the cost. Therefore, convincing the use of AI for health insurance is an important point about the importance of AI technologies, as it will often influence the use by health professionals [12].

Regarding reliability, for the physician, companies developing these systems have to convince physicians that the system is effective and brings quality benefits. As for the agreements, it will be in relation to the cost, which will reduce in other aspects and exams, because, thus, they will encourage health professionals to use according to the need, without restrictions. Some ophthalmologists responded that it was necessary to work with resource sharing to manage the cost challenge. In Baghdad, 5 of them bought the equipment in partnership, which is available to each one, once a week.

In dentistry, many of the professionals are not covered by an agreement, further impacting the cost challenge, as sometimes the patient is not willing to pay for the private exam. Some respondents reported that the cost-benefit is not valid for the area of operation. Depending on the case, they refer the patient only for the examination to be carried out with another professional who has the technology [12].

4.4. Perception of the Impact of AI on the Decision-Making Process. Two impacts caused within the decision-making process by the use of AI were presented in the literature: (1)

assistance in diagnosis and (2) assistance in doctor × patient interaction. The respondents' reports showed that the aid in the diagnosis occurs through: (1) complementation of the clinical diagnosis and the (2) level of confidence in the diagnosis offered by the system [13].

The question of AI replacing or complementing clinical diagnosis is still discussed in the literature [12]. From the data collection, it was observed that most professionals who participated in the research consider that the use of AI complements the analyses carried out by them, not replacing the human diagnosis, corroborating the studies by Mazzochi. Respondents consider clinical analysis an important step in the decision-making process. They also point out that only with the use of AI, the patient cannot define his diagnosis, emphasizing the importance of the physician's role in the diagnostic process as mentioned by Areiqat and Alheet [12]. Most professionals consider clinical analysis paramount. There are also cases where the diagnosis made by clinical examination may appear normal, but when performing the OCT, for example detecting the early stage of the retinal disease due to diabetes. Even in this case, the clinical examination is essential to analyze the patient's health history complaints and requests tests to help confirm the diagnosis.

In relation to the health professional × patient interaction, two questions were observed: (1) diagnosis of health by the patient himself from the AI and (2) credibility in the diagnosis through AI. Respondents point out that only with the use of AI, the patient cannot define his diagnosis with complete safety, requiring a professional evaluation. In addition, only the professional can confirm and proceed with the treatment indicated for the disease. Regarding the credibility of the diagnosis through AI, most point out that it increases and that they perceive the patient's positive reaction when seeing the result presented by the AI, with the confirmation and explanation of the health professional, as they will often help to understand that is not tangible.

4.5. Perception of the Impact of AI on Service Quality. The literature [15] presents 3 impacts of AI on the quality of care: (1) quality, (2) interoperability, and (3) security. For the respondents inserted in these 3 impacts, there is an increase in the doctor-patient relationship and the transformation of the patient's experience, as mentioned in the literature by Zhang, et al.

Many of the respondents reported that they had an increase in the time of this relationship and transformed the patient experience for the better, with a diagnosis made more comfortably, quickly, and effectively. As reported by a dentist, through the intraoral scanner, it is possible to make the diagnosis more visible to the patient, showing if any treatment is necessary and the options offered in orthodontics. This visibility increases the patient's safety and confidence in the professional, corroborating the study presented by Naumov [16].

5. Conclusions

This research began by contextualizing AI, its impacts, and its uses in ophthalmology and dentistry. To evaluate its impact on the decision-making process of the health professional and the quality of care, the result for the author is conclusive and satisfactory. Research on such current topics proved to be more complex than expected. Even though it is well disseminated in some areas of knowledge, AI does not have great references to base and deepen, especially when the focus is on the quality of the result it offers, which is one of the great difficulties for applying the technological update. Processing large amounts of data is possible and easily achievable for AI, but at the same time, it is difficult to use them, as a high volume of data is required to find assertive patterns. The need for a professional to always monitor performance and guide AI in health processes is evident that it is necessary. AI can identify/analyze a case in a short period compared to a human being, but it is not possible to replace the professional for personal treatment.

According to Areiqat, et al. [3], "Technology is just a tool, and the degree of success it has depends on how individuals respond to it." In other words, the professional's interaction with the interfaces, and the result through assertiveness, is the report of his success. Suggestions for future research on the topic are: the patient experience impacted by AI and analyzing whether health professionals' perception coincides with that of patients. The perception of professionals to contribute to system developers in improvements in existing technologies or new ones that will continue to assist in decision-making.

Data Availability

The data underlying the results presented in the study are available within the article.

Conflicts of Interest

The authors declare that they have no conflicts of interest regarding the publication of this article.

References

[1] S. Khanam, S. Tanweer, and S. Khalid, "Artificial intelligence surpassing human intelligence: factual or hoax," *The Computer Journal*, vol. 64, 2020.

[2] M. Mirbabaie, S. Stieglitz, and N. Möllmann, "Artificial intelligence in disease diagnostics: a critical review and classification on the current state of research guiding future direction," *Health Technology*, vol. 11, 2021.

[3] Y. K. Dwivedi, L. Hughes, E. Ismagilova et al., "Artificial Intelligence (AI): multidisciplinary perspectives on emerging challenges, opportunities, and agenda for research, practice and policy," *International Journal of Information Management*, vol. 57, Article ID 101994, 2021.

[4] M. Gams, "Alan turing, turing machines and stronger," *Informatica*, vol. 37, pp. 9–14, 2013.

[5] J. F. Arinez, Q. Chang, R. X. Gao, C. Xu, and J. Zhang, "Artificial intelligence in advanced manufacturing: current status and future outlook," *Journal of Manufacturing Science and Engineering*, vol. 142, no. 11, pp. 1–53, 2020.

[6] A. Khadidos, A. Khadidos, O. M. Mirza, T. Hasanin, W. Enbeyle, and A. A. Hamad, "Evaluation of the risk of recurrence in patients with local advanced rectal tumours by

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Volume 2023, Article ID 9840913, 1 page
https://doi.org/10.1155/2023/9840913

Retraction

Retracted: Study on the Impact of Chinese Comedy International Communication on the Health of Older People under Cultural Ecological Environment

Journal of Environmental and Public Health

Received 15 November 2022; Accepted 15 November 2022; Published 30 January 2023

Journal of Environmental and Public Health has retracted the article titled "Study on the Impact of Chinese Comedy International Communication on the Health of Older People under Cultural Ecological Environment" [1] due to concerns that the peer review process has been compromised.

Following an investigation conducted by the Hindawi Research Integrity team [2], significant concerns were identified with the peer reviewers assigned to this article; the investigation has concluded that the peer review process was compromised. We therefore can no longer trust the peer review process, and the article is being retracted with the agreement of the Chief Editor.

References

[1] Y. Zhang, W. Wang, and J. Wei, "Study on the Impact of Chinese Comedy International Communication on the Health of Older People under Cultural Ecological Environment," *Journal of Environmental and Public Health*, vol. 2022, Article ID 4003853, 7 pages, 2022.

[2] L. Ferguson, "Advancing Research Integrity Collaboratively and with Vigour," 2022, https://www.hindawi.com/post/advancing-research-integrity-collaboratively-and-vigour/.

Hindawi
Journal of Environmental and Public Health
Volume 2022, Article ID 4003853, 7 pages
https://doi.org/10.1155/2022/4003853

Research Article

Study on the Impact of Chinese Comedy International Communication on the Health of Older People under Cultural Ecological Environment

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Received 7 April 2022; Revised 28 April 2022; Accepted 9 May 2022; Published 12 July 2022

Academic Editor: Sivakumar Pandian

There are many kinds of works in Chinese comedy culture, which are deeply loved by audiences at home and abroad. In order to explore the impact of the international spread of Chinese comedy culture in the ecological environment on the health of the elderly public, this study studied these elderly comedy audiences from the aspects of age, monthly income, physical health, mental health, and public stability through statistical methods. The results show that the international spread of Chinese comedy culture is conducive to the physical and mental health of the elderly public, relieves the pressure of life, and ultimately contributes to social harmony and stability.

1. Introduction

The types of works in China's comedy culture market are divided into film and television comedy, stage comedy, and humorous quyi. In addition to traditional humorous quyi, such as cross-talk and storytelling, talk shows, and sketches in quyi, stage drama comedy and film and television comedy belong to the form of comedy combining Chinese and Western. Film and television comedies with low threshold and stage comedies and humorous quyi with high consumption form cultural products for healthy consumption of consumers at different levels. And because of the mobile phone short video and other auxiliary communication tools, humorous quyi and stage comedy, which usually consume thousands of yuan to thousands of yuan, can also realize people-friendly communication, forming a unique comedy form such as hilarious online segment video. When watching comedy culture, consumers of different ages and monthly incomes can mediate their mood, relieve their inner emotions, and let the elderly audience relax, so as to promote social harmony and stability. Comedy cultural products can make the audience fully relax and alleviate the pressure of life, so as to achieve the ultimate goal of promoting public health. With the development of China's comedy culture market, we should increase the breadth and depth of the content of comedy culture, improve the original effect of comedy itself, pay more attention to the objectivity and effectiveness of supervision and audit, and let China's comedy culture play a greater positive role in the process of international communication in the ecological environment because laughter can not only meet other human needs but also meet other human needs at more levels. At the same time, comedy laughter can also meet the needs of human beings at all levels. Psychological balance can make people calmly deal with the changing environment around them, so as to achieve health and longevity. In real life, not all goals can be achieved and all needs can be met. Setbacks and failures are inevitable. Anxiety and tension will often invade the body and mind. In the ecological environment, the spread of Chinese comedy culture can relieve tension and

anxiety while relaxing and enjoying. It helps to eliminate physical and mental fatigue and maintain immune mechanism, improve life vitality, and strengthen physical strength and energy.

This study used statistical methods to deeply study the impact of Chinese comedy on the elderly public health, mainly through the audience analysis of consumers of different ages and different monthly incomes on different cultural communication platforms and comedy culture in terms of physical health, mental health, and public stability. The results show that comedy culture is conducive to the physical and mental health development of the audience; the previous cultural communication methods and comedy culture can no longer meet the needs and development of the public. Today, with the high development of science and technology, it provides new ideas, new methods, and new platforms for the communication of Chinese comedy culture. Knowing that the improvement of living standards and the pressure of life make the spiritual needs of the elderly public more and more intense and relieve the pressure of depression and anxiety, we can help alleviate our inner emotions through the appreciation of comedy culture, so as to ensure the health of the elderly public.

2. Literature Review

Liu, due to the rapid development of domestic comedy films, can bring spiritual enjoyment to the audience. At the same time, the entertainment consumption market of cinemas is also increasing day by day and has made good achievements. The spiritual needs of consumers are also higher and higher, which can make the audience feel happy in the comedy culture [1]. Xie and Chang described that comedy aesthetic education is related to the shaping of the national soul and the spiritual construction of the times. Therefore, strengthening the role of the wind vane of the mainstream media, increasing the demonstration and guidance of high-quality comedies, strengthening the education of comedy aesthetics in schools, and building and optimizing the three-dimensional system of comedy communication are the only way to build a harmonious and healthy comedy aesthetics and can promote the dissemination and development of Chinese comedy culture [2]. In recent years, comedy plays a more and more important role in China's entertainment consumer market, and the audience's demand for comedy is becoming stronger and stronger. Wang takes the traditional comedy culture company as the main research object. By analyzing the strategic decision of its commercialization transformation, he summarizes the correct direction and value orientation of the comedy culture industry chain and then explores the comedy industry marketing strategy with both innovation and general moderation [3]. Li and Wu under the changes of the times, the comic spirit has become an important feature in his creation, giving new aesthetic symbols to contemporary literary creation. This paper expounds the connotation of comic spirit and discusses the gradual change of comic spirit in literature since the new era [4]. Liu as relaxed, humorous, sharp, and interesting literary and artistic content has become the rigid demand of the current society; comedy culture has begun to penetrate into all aspects of literary and artistic creation and also reflects the changing aesthetic trend of the times [5]. Hao in recent years, the application of short video, has grown rapidly. Its communication mode of integrating video, listening, sound, and painting has updated the habits of modern people to receive information and socialize. At the same time, it also provides a new platform for knowledge communication, such as traditional culture communication, and has attracted the attention of a large number of audiences [6]. The material of comedy comes from life. The good things and memories in life are worth recording, so as to awaken the love of comedy culture. With the development of comedy, it can be seen that comedy can bring more and more happiness to the public, whether it is physical or psychological. Zang based on comedy culture, starting from the psychology of the audience and through the localized creative mode, rendered the atmosphere of empathy, so as to realize group empathy and continue the spiritual core of comedy; and cater to the aesthetic preference of the audience in the consumption era. Emotionally, it carries the space of empathy, soothes the inner dilemma and anxiety of modern people through emotional resonance, and better promotes public health [7]. Xie and Cheng pointed out that comedy culture must break through the international siege and explore and tap the comedy phenomenon and comedy spirit in real life in the comedy consciousness [2].

Table 1: Audience analysis of Chinese comedy by the age group.

Grouping	<25	25–35	35–50	>50
Cinema	22.9	14.2	5.3	3.6
Grand theater	7.8	11.3	11.5	6.9
Bar stage	15.4	18.3	25.5	33.6
PC/tablet	8.6	14.1	19.1	22.4
Mobile phone	45.3	42.1	38.6	33.5

3. Analysis of Chinese Comedy Audience

With the development of Chinese comedy culture, there are many types of comedy, such as comedy film, comedy theater, and music comedy. Table 1 provides the viewing platforms of comedy audiences according to different ages and the number and proportion of each type of comedy audience.

In Table 1, comedy audiences younger than 25 years old tend to watch comedies in cinemas and through mobile phones when they watch comedies through cinemas, grand theaters, small stages in bars, computers/tablets and mobile phones, which is easier for contemporary young people to reach; comedy audiences aged 25–35 prefer to watch comedy through mobile phones and small stages in bars; audiences aged 35–50, like comedy audiences aged 25–35, watch comedy mainly through mobile phones and small stages in bars; when they are older than 50, they mainly watch comedies through mobile phones and bars. Figure 1 is drawn following the data in Table 1 to facilitate readers' understanding and comparison of the data.

As shown in Figure 2, the audience for comedy in the cinema decreases with age, that is, most of the people who go

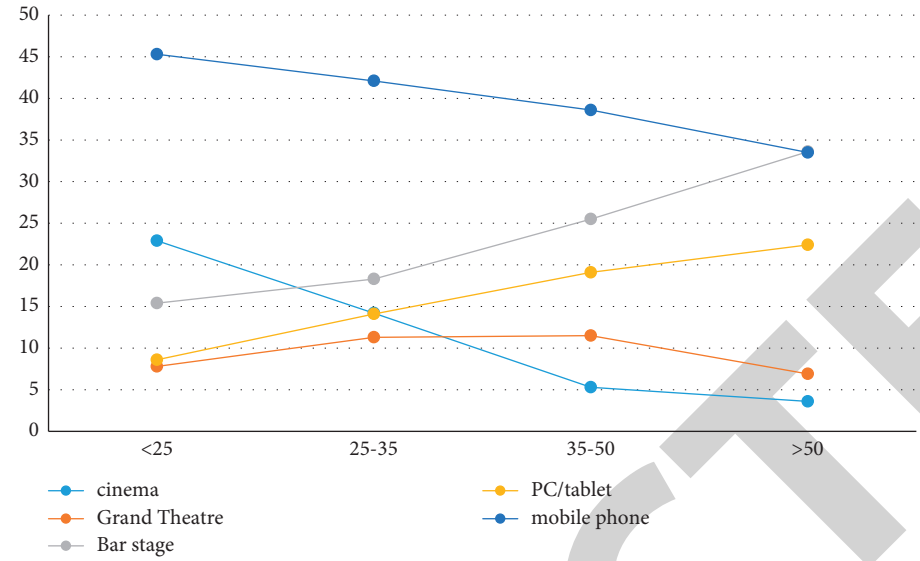

Figure 1: Audience analysis of Chinese comedy under the age group.

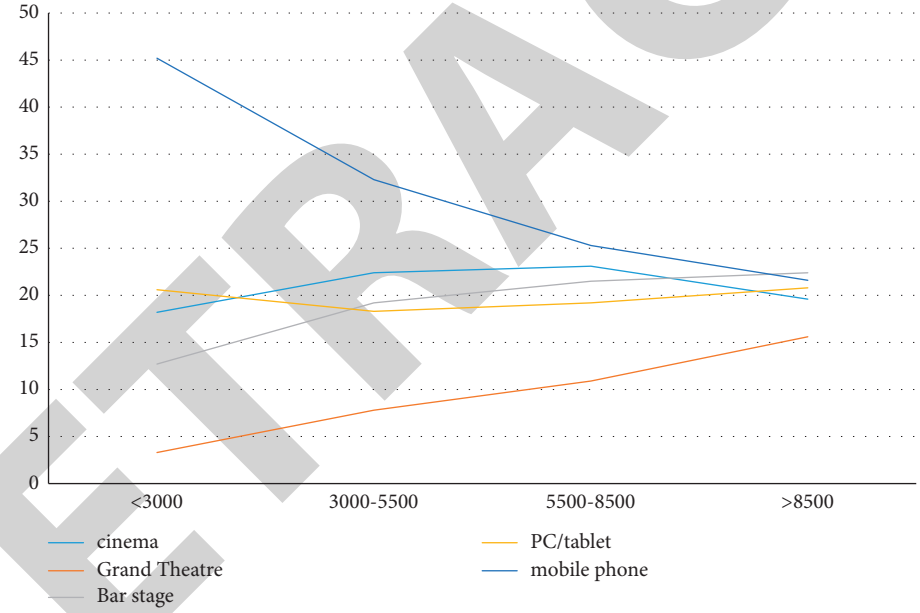

Figure 2: Analysis of Chinese comedy audience under the income group in February.

to the cinema are young people, and the older audience rarely goes to the cinema to watch comedy programs, but through mobile phones, computers, or tablets; on the contrary, the audience who watch comedy through the small stage of the bar increases with age [8].

At the same time, the monthly income of these comedy audiences is grouped to see the impact of different consumption levels on these audiences. After statistics, the data in Table 2 are obtained.

In Table 2, it can be seen from the data that comedy audiences with a monthly income of less than 3000 watch comedy mainly through mobile phones, computers, tablets, and cinemas, which do not need consumption or have low consumption. With the increase of income, it is not limited by this. You can watch comedy in theaters or bars. Figure 2 is drawn based on the data in Table 2 to facilitate a better understanding of the data.

In Figure 2, when the income is more than 8500 yuan, all ways to enjoy comedy are evenly distributed, about 20%. Most audiences at this income level have no consumption restrictions and can enjoy comedy at will. With the decrease in monthly income, the proportion of watching through mobile phones increases.

4. The Influence of Comedy Appreciation on Residents' Mental Health

To study the impact of watching comedy on the mental health of the elderly audience, the depression and anxiety of the elderly audience were rated. The data in Table 3

Table 2: Audience analysis of Chinese comedy by the income group in February.

Grouping	<3000	3000–5500	5500–8500	>8500
Cinema	18.2	22.4	23.1	19.6
Grand theater	3.3	7.8	10.9	15.6
Bar stage	12.7	19.2	21.5	22.4
PC/tablet	20.6	18.3	19.2	20.8
Mobile phone	45.2	32.3	25.3	21.6

Table 3: Impact of comedy appreciation on residents' mental health.

Grouping	0 h	1 h	2 h	3 h	4 h	5 h
Depression rating	6.39	5.29	5.08	4.92	4.96	5.36
Anxiety rating	6.18	5.03	4.85	4.73	4.81	5.16

were obtained by classifying the length of time of enjoying comedy.

In Table 3, it can be seen that the score of depression and anxiety rating for the audience who did not enjoy comedy is higher, while the score of rating decreases with the increase of the time of enjoying comedy, but the score will increase after the time is longer than 4 hours, which also shows that not watching comedy for a long time will also affect people's mental health and make people anxious. Figure 3 is drawn following the data in Table 3.

It can be seen from Figure 3 that the rating scores of depression and anxiety develop in a U-shape with the increase of time, which shows that there is an optimal time for watching and appreciating comedy, rather than the longer the time, the better. Beyond the best time, appreciation time is not conducive to the mental health development of the elderly audience.

5. Impact of Comedy Appreciation on Residents' Physical Health

After analyzing the mental health of the elderly audience who appreciate comedy, we will make a statistical analysis on the physical health of the elderly audience and make statistics on the prevalence of various diseases of the elderly audience watching for different lengths of time, so as to obtain the data in Table 4.

In Table 4, it can be seen from the data of various physiological diseases that the appreciation of comedy can reduce the prevalence of diseases such as three high and ventilation, which shows that watching comedy programs can adjust the physical function of the elderly, which is conducive to the healthy development of the elderly. Figure 4 is drawn based on the data in Table 4.

It can be seen from Figure 4 that with the extension of comedy appreciation time, the probability of suffering from various diseases will be reduced, which shows that comedy appreciation can be used to maintain the health of the elderly audience.

6. The Role of Comedy in Maintaining Stability of the Chinese Public

This study mainly discusses the impact of the international spread of Chinese comedy culture on the elderly public health. The above research is from the aspects of physical health and mental health and then from the aspect of social public stability maintenance, mainly from four observation indicators. The data are statistically analyzed to obtain the data in Table 5.

In Table 5, it can be seen that the audience who did not watch comedy scored higher on social contradictions and social negative factors, and the score will gradually decrease with the increase of the duration of enjoying comedy. Figure 5 is drawn following the data in Table 5.

As shown in Figure 5, the longer you watch comedy, the lower your score on social contradictions and social negative factors, which shows that watching and appreciating comedy is beneficial to the people with social contradictions and negative attitudes, the physical and mental health of the elderly audience, and the stability of the public.

7. The Overall Development View of Chinese Comedy

7.1. Appropriately Increase the Channels for the Masses to Contact International Chinese Comedies. With the further development of China's economy, the number of screens in China shows a high growth trend. At the same time, the income of Chinese people begins to enter the level of middle-income countries, and most people have entered a well-off life. However, it also faces a series of problems, such as difficult medical treatment, expensive school, serious social polarization between the rich and the poor, environmental pollution and so on. Many ordinary people will feel the depression and helplessness of life. At this time, they will find a way to relieve their worries and vent their emotions. Therefore, there are more and more comedies, and the market is getting hotter and hotter. Comedies spread and develop rapidly in various ways. The audience of online self-made sitcoms is mainly young people. They watch online

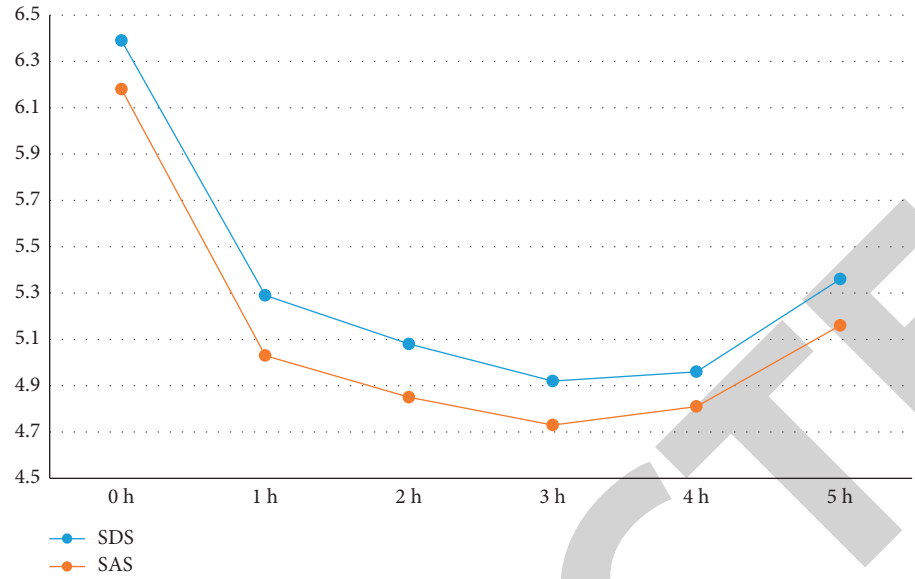

Figure 3: Analysis of the impact of comedy appreciation on residents' mental health.

Table 4: Impact of comedy appreciation on residents' physical health.

Grouping	0 h	1 h	2 h	3 h	4 h	5 h
Three high	21.6	19.3	18.6	18.1	17.9	17.8
Improve air circulation	5.2	4.9	4.7	4.6	4.5	4.5
Gynaecopathia	24.3	22.5	21.4	20.6	20.3	20.1
Andrology	18.6	17.1	16.3	15.8	15.6	15.5
Endocrine disorder	32.4	30.9	28.7	28.1	27.8	27.6

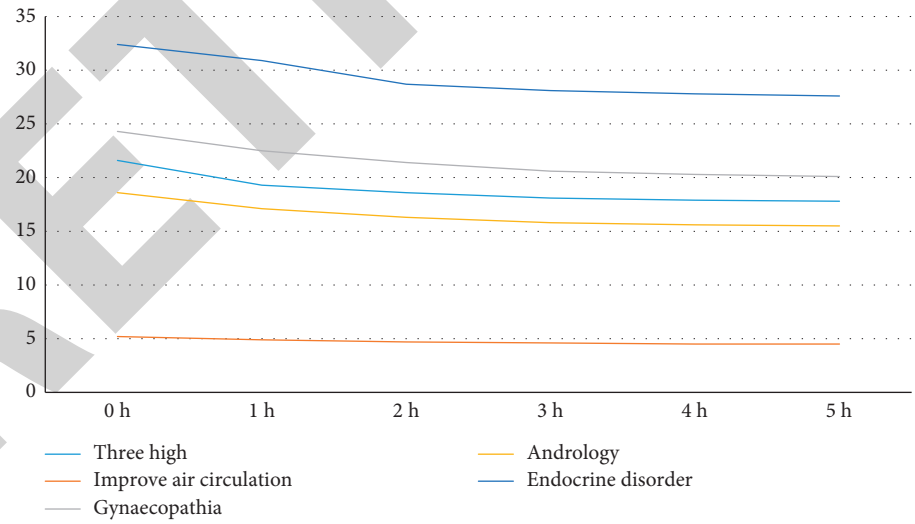

Figure 4: Analysis of the impact of comedy appreciation on residents' physical health.

Table 5: The role of comedy in maintaining the stability of the Chinese public.

Grouping	0 h	1 h	2 h	3 h	4 h	5 h
Family contradiction	27.6	24.3	23.5	23.1	22.7	22.4
Contradiction between cadres and the masses	18.2	16.3	15.9	15.7	15.6	15.5
Make trouble	4.9	4.2	3.9	3.7	3.6	3.5
Campus violence	8.7	7.2	6.8	6.5	6.4	6.4

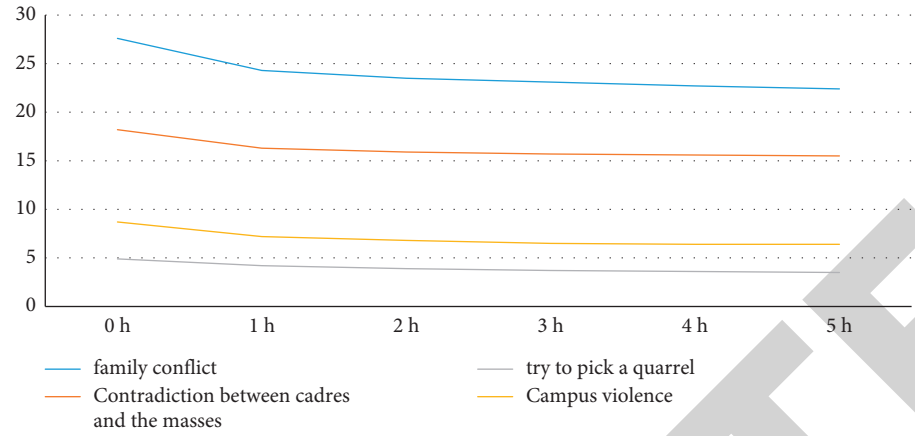

Figure 5: Analysis of the role of comedy in maintaining stability of the Chinese public.

self-made sitcoms with entertainment, catharsis, curiosity hunting, and conformity. At the same time, two-way and multidirectional communication interaction has been formed between the audience, video websites, and the audience. Nowadays, there are more and more elderly people, and the lineup of the elderly audience is also larger and larger. Pay attention to the concerns of the elderly audience, from scientific health preservation to promising old people, and enrich the spiritual life of the elderly.

In Zhu's analysis of the program innovation of "happy comedian" from the perspective of communication, taking "happy comedian" as an example, the hit volume in TV stations and online videos reached more than 10 billion. Through the integration of cross-talk, sketch, juggling, quyi, mime, and other forms, it improved the cultural connotation of the program, expanded the program communication channels, enriched the audience integration mode, and created a unique cultural communication direction of comedy variety shows [9]. Wang and Wang mentioned in their discussion on the emergence and characteristics of online dramas that online comedies have grown from scratch, from self-made online dramas to phenomenal popular online dramas, and then to the more diversified content of online comedies. The audience has also changed from one-way recipients to users who can choose and participate, with changes in attitude and action [10]. Qian in the positive role of comedy short video in the dissemination of urban image, taking comedy short video as an example, in the Internet era, various short video software are rising rapidly. Short video has strong communication function and commercial value, and its integration degree is high [11]. Rao and Yin mentioned in the new pattern of Chinese films and comedy film creation that the increase of hardware facilities of domestic comedy films, such as the number of screens in cinemas and the growth of new communication channels, has also increased the capacity of the market [12]. Under the macro background of the country's vigorous development of creative industry, the communication mode of contemporary Chinese comedy has long been derived from a single stage to a broader media platform. The centralized outbreak of Chinese comedy is also the result of the joint action of internal and external factors of Chinese films. The pressure in life makes more people choose comedy culture to alleviate their inner emotions, feel comedy culture through different communication platforms, better develop comedy channels, and further promote the development of comedy culture. The diversity of comedy development makes the acceptance of comedy by the elderly audience more and more common. The value judgment in comedy culture will also make the elderly audience aftertaste the value of comedy culture after laughing.

7.2. Properly Control the Social Phenomenon of Excessive Consumption. From the current development of China's comedy market, some works are over marketed, the content is single, ignoring the commitment of social responsibility, lack of guidance to teenagers, lack of thinking about the real society, and ignore the bottom line of moral principles. Both the form of expression and the content of the story have lost their cultural value. In particular, some low-cost comedy films blindly imitate and follow the trend in order to achieve high box office. Although the content of the works is humorous, they have lost the cultural value of comedy itself. Chinese comedy has achieved diversified development in the form of creation, and its strong local advantages have become an effective weapon for the differentiated competition between Chinese films and foreign commercial films. But there are also many problems behind the wonderful, such as the narration, creativity and branding of Chinese comedy films. We must further improve the quality and win the audience and market in order to win the space for sustainable development. Chinese comedies seem to be trying their best to get rid of the image of "vulgar." In addition to the funny bifurcated passages, whether the works can bring emotional resonance to the audience is successful. The performance form of comedy culture is characterized by illogical and slightly neurotic. The colorful performance form and vulgar comedy culture will make the audience laugh happily. After that, it has no value of comedy connotation. It needs to arouse deep thinking. When winning the box office, we should also pay attention to the

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Journal of Environmental and Public Health
Volume 2023, Article ID 9819810, 1 page
https://doi.org/10.1155/2023/9819810

Retraction

Retracted: Impaction of Rehabilitations and Strengthening Programs before and after Anterior Cruciate Ligament Reconstruction in Return to the Fitness Level

Journal of Environmental and Public Health

Received 27 June 2023; Accepted 27 June 2023; Published 28 June 2023

This article has been retracted by Hindawi following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of one or more of the following indicators of systematic manipulation of the publication process:

(1) Discrepancies in scope
(2) Discrepancies in the description of the research reported
(3) Discrepancies between the availability of data and the research described
(4) Inappropriate citations
(5) Incoherent, meaningless and/or irrelevant content included in the article
(6) Peer-review manipulation

The presence of these indicators undermines our confidence in the integrity of the article's content and we cannot, therefore, vouch for its reliability. Please note that this notice is intended solely to alert readers that the content of this article is unreliable. We have not investigated whether the authors were aware of or involved in the systematic manipulation of the publication process.

Wiley and Hindawi regrets that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our own Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

References

[1] A. A. Alzahrani, "Impaction of Rehabilitations and Strengthening Programs before and after Anterior Cruciate Ligament Reconstruction in Return to the Fitness Level," *Journal of Environmental and Public Health*, vol. 2022, Article ID 7906341, 7 pages, 2022.

Hindawi
Journal of Environmental and Public Health
Volume 2022, Article ID 7906341, 7 pages
https://doi.org/10.1155/2022/7906341

Research Article

Impaction Of Rehabilitations And Strengthening Programs before And after Anterior Cruciate Ligament Reconstruction In Return to the Fitness Level

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Received 14 May 2022; Revised 4 June 2022; Accepted 10 June 2022; Published 9 July 2022

Academic Editor: Sivakumar Pandian

Objectives. Sports injuries are one of the most common orthopedic injuries particularly in young and active populations. Football is the most popular sport among Saudis, and thus, anterior cruciate ligament (ACL) injuries are common in clinics and emergency rooms in Saudi Arabia. The aim of this study was to evaluate the outcomes of patients six months after ACL reconstruction in both hospitals and gym-based rehabilitation services and its impaction on the patients to return to sports and preinjury fitness levels. *Methods*. This is a retrospective case series of patients who underwent arthroscopically assisted ACL reconstruction using a hamstring autograft at our center. Data were gathered from January 2020 to December 2020. Patients were given a questionnaire about their visits to the orthopedic clinic in the 6th month after surgery. *Results*. Sixty patients with ACL reconstructions were studied. Noncontact sports were the leading cause of injuries (53.3%). The mean Lysholm score was 84.9 (SD 3.45) out of 100 after six months of follow-up, and the mean Tegner score was 4.77 (SD 1.06) out of 10 points. The Lysholm score was excellent (>90) among 5% (n= 3), good (84–90) among 60% (n= 36), and fair (65–83) among 35% (n= 21). As a result, we observed that the duration of postoperative rehabilitation has a significant relationship with the fitness level ($X2$= 18.711; p = 0.001).*Conclusion*. The Lysholm knee scoring scale and the Tegner activity scale showed that arthroscopically assisted ACL reconstruction using hamstring autograft has a successful and functional outcome after which the patient returns to sports or regains the preinjury level of fitness level depends on the rehabilitation.The period and types of preoperative and postoperative rehabilitation have a direct impact on the return to fitness levels and normal daily life activities.

1. Introduction

Anterior cruciate ligament (ACL) injuries are common in clinics and emergency rooms. The ACL is the knee's primary stabilizer and prevents femur translation onto the tibia. In the United States, there are over 127,000 ACL reconstruction surgeries and 250,000 new ACL cases per year. [1] Discomfort while walking, inflammation, weakness, and signs of knee instability such as giving way and a reduction in athletic activities are all symptoms of ACL rupture [2].The gold standard surgical treatment is graft reconstruction followed by intensive rehabilitation [3]. A patient with ACL injury has a significant decrease in the activity, daily living, and low knee functional indicators, especially with a bilateral knee involvement [4]. Hamstring muscle tendon autograft has less complication rate in comparison to other autograft options. [5–7].

Preoperative and postoperative rehabilitation protocol exercise in the hospital and at the gym is crucial to returning to normal daily life activities. Physiotherapy is expected for at least two months with a minimum of four sessions per week. Restoring to full sport activities is contingent on completing a postoperative workout program, which can be completed six months after surgery [8]. The period of rehabilitation and the extent of the strengthening exercise program are strongly linked to a quick return to daily life

activities and fitness levels [9]. The aim of this study was to identify and assess patients' functional outcomes six months after ACL reconstruction and their return to sports and daily life activities via both hospital- and gym-based rehabilitation, by using reliable and applicable international scoring tools. Two numerical rating questionnaires, which were introduced in 1985 by Tegner and Lysholm, were used to assess functional knee instability [10].

2. Materials and Methods

This was a retrospective case series of patients who underwent arthroscopically assisted ACL reconstruction using hamstring autografts at King Fahad Hospital in the Al-Baha region of Saudi Arabia.

This site is designated as a tertiary hospital by the Ministry of Health (MOH). Patients were treated and managed by one experienced arthroscopic surgeon. Hamstring autograft was used to treat all patients.

2.1. Procedures. All patients received the same preoperative instructions including prophylactic antibiotics and shaving 30 minutes prior to anesthesia. Spinal anesthesia was used in all patients, and the pivot test was used as the final diagnostic tool. Patients were placed in a supine position with a hanging leg in a leg holder; the tourniquet was applied at 250 mm Hg. Landmarks were placed using anteromedial and anterolateral portals.

2.2. Surgical Technique. Gracilis and semitendinosus tendons were harvested then sutured with sutures (Ethibond) using the Krackow technique. This followed the release of the bands attached to each tendon.

An incision was made for imaging, and a camera was inserted through the lateral port. The instrument was inserted through the medial port. The medial and lateral menisci, ACL, posterior cruciate ligament (PCL), and medial and lateral femoral condyles of the knee were inspected. The ACL traces at the insertion and origin sites were shaved away which spared some of the foot print at the tibial site for proprioception.

Tibial tunneling was done at the middle of the ACL footprint. The tibial guide was inserted approximately 7 mm anterior to the PCL and 2–3 mm anterior to the tip of the medial spine. Reaming was done after insertion of a Kirschner wire (K-wire) through the tibial guide.

Femoral tunneling used an accessory anteromedial port with insertion of the femoral guidewire behind the footprint of the native ACL. The knee was then flexed more than 110°.

For graft passage, the suture loop was passed through the femoral tunnel followed by a crocodile pass of the suture along the tibial tunnel. The end button and an absorbable interference screw was used along with a stapler to secure the graft while tensioning it in an extended knee position. Finally, the patient was put in a knee stabilizer.

From January 2018 to December 2019, data were collected from 68 patients who met the inclusion criteria, except for eight patients who were unable to participate in the research study. The patients were all males between 19 and less than 45 years old with no comorbidities and a body mass index (BMI) in-between 19 and 30. All subjects had an isolated ACL tear and could perform postoperative recovery exercises. Sixty patients were involved in this study. Questionnaires were distributed to the patients six months after their orthopedic surgery. All subjects gave informed verbal consent before participating in the questionnaires.

The Lysholm score and the Tegner scales were used to assess patient outcomes. The Lysholm Scale is a reliable scoring system that includes the following eight elements: discomfort, swelling, limping, squatting, locking, instability, stair climbing, and the need for help [1]. The return to daily life activities and the normal level of fitness were assessed using direct questions.

2.3. Statistical Analysis. When applicable, the data were presented in the form of numbers, percentages, means, and standard deviations. The independent *t*-test and one-way ANOVA were used to compare the Lysholm and Tegner scores to patients' diagnostic criteria.

Fischer's exact test was used to investigate the relationship among restoring the fitness level, recovery extent, and recovery period. In all statistical studies, a P value of 0.05 was considered significant. All statistical analyses for this project were performed using Statistical Packages for Social Sciences (SPSS) version 21 (IBM Corporation in Armonk, New York).

3. Results

We analyzed sixty patients who underwent ACL reconstruction. The clinical characteristics of the patients with ACL injury are listed in Table 1. The most common cause of injury was noncontact sports (36.7%) followed by contact sports (36.7%). More than half of those surveyed (51.7%) injured their dominant leg.

The main concern of 71.7% of the patients was instability. Furthermore, 51.7% had a gap of more than a year between the injury and the surgery. The most common types of rehabilitation (43.3%) were regular hospital rehab and gym rehab, and the most common rehabilitation period was less than a month (36.7%).

Likewise, one-third of the patients expressed an interest in resuming their previous level of fitness. The mean Lysholm and Tegner scores were 84.9 and 4.77, respectively, with an average of 8.98 weeks for returning to normal daily activities.

Figure 1 presents the Lysholm score categories: 60% of the patients ($N = 36$) had a good score(84–90), 35% of the patients ($N = 21$) had a fair score (65–83), and only 5% of the patients ($N = 3$) had an excellent score (>90).

When the Lysholm and Tegner scores were compared to the clinical characteristics of the patients, we found that those who did not participate in a recovery program had substantially lower Lysholm ($F = 7.895$; $p < 0.001$) and Tegner ($F = 7.233$; $p < 0.001$) scores. Similarly, there was a substantial difference in Lysholm ($F = 4.749$; $p < 0.001$) and

Table 1: Clinical characteristics of patients with an ACL injury (n= 60).

Variables	N (%)
Mode of injury	
(i) Road traffic accident (RTA)	01 (01.7%)
(ii) Falling	05 (08.3%)
(iii) Contact sport	22 (36.7%)
(iv) Noncontact sport	32 (53.3%)
Dominant leg	
(i) Right	31 (51.7%)
(ii) Left	29 (48.3%)
Chief complaint	
(i) Instability	43 (71.7%)
(ii) Locking	04 (06.7%)
(Iii) Both	13 (21.7%)
Duration between the injury and the surgery	
(i) < 6 months	08 (13.3%)
(ii) > 6 months and <1 year	21 (35.0%)
(iii) > 1 year	31 (51.7%)
Types of rehabilitation	
(i) Standard hospital rehab program	20 (33.3%)
(ii) Gym rehab	11 (18.3%)
(iii) Both	26 (43.3%)
(iv) None	03 (05.0%)
The duration of post-operative rehabilitation	
(i) Less than one month at the hospital	13 (21.7%)
(ii) More than two months at the hospital	07 (11.7%)
(iii) Less than one month at a gym	02 (03.3%)
(iv) More than two months at a gym	09 (15.0%)
(v) Less than one month in both	04 (06.7%)
(vi) More than two months in both	22 (36.7%)
(vii) None	03 (05.0%)
Returning to the fitness level	
(i) Yes	20 (33.3%)
(ii) No	40 (66.7%)
	Mean ± SD
Lysholm scoring scale	84.9 ± 3.45
Tegner score	4.77 ± 1.06
Returning to normal daily activities in weeks	8.98 ± 1.35

Tegner scores (F= 4.640; p = 0.001) with the period of postoperative recovery.

Furthermore, those who returned to their previous fitness levels had substantially higher Lysholm (T= 6.537; p < 0.001) and Tegner (T= 7.317; p < 0.001) scores. When then compared both Lysholm and Tegner ratings with other clinical features of the patients such as the mode of injury, dominant leg, and time between the injury and the surgery. There was no substantial difference (all p > 0.05). Table 2 shows the statistical difference between Lysholm and Tegner scores in relation to the clinical characteristics of patients with ACL injury (n= 60).

Figure 2 shows the correlation between Lysholm and Tegner scores. Correlation between Lysholm and Tegner scores was positively highly and statistically significant (r= 0.827; p < 0.001), and the Lysholm knee score and the Tegner activity scale demonstrated acceptable psychometric performances as outcome measures for patients with knee injury.

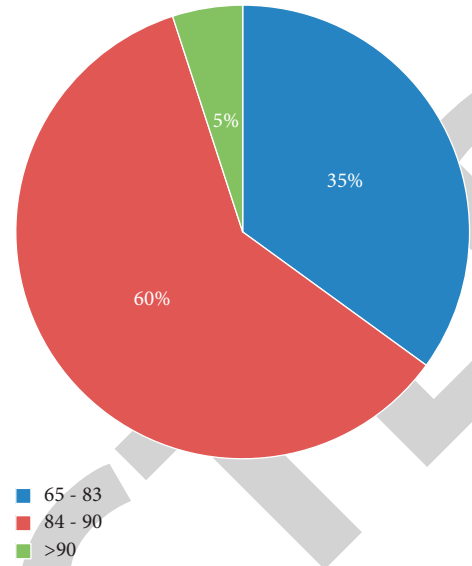

Figure 1: Postoperative Lysholm score.

Figure 3 shows the correlation between the Lysholm score and returning to normal daily activities time in weeks. There was a highly but inverse correlation between the Lysholm score and returning to normal daily activities time in weeks (r= -0.694; p < 0.001).

Figure 4 shows the correlation between the Tegner score and the time needed to return to normal daily activities in weeks. There was a negative highly significant correlation between the Tegner score and that time interval (r= -0.713; p < 0.001).

We then compared the period of postoperative rehabilitation to the return to the fitness level: the duration of postoperative rehabilitation had a substantial impact ($X2$= 18.711; p= 0.001), but the form of rehabilitation did not have the similar impact (X^2= 2.724; p= 0.005). Table 3 shows the relationship between returning to the fitness level and the type of rehabilitation including rehabilitation duration (n= 60).

4. Discussion

The results revealed that the patients' functional outcomes were generally good. According to the Lysholm knee-scoring scales, the mean score was 84.9 (3.45) out of 100 with 60% of the patients having good results (Lysholm score 84–90); 35% had fair results (Lysholm score 65–83), and the remaining 5% had excellent results (>90). The grading system was obtained from the study of Misou et al. [11] A Pakistani study found that more patients had excellent functional outcomes as calculated by the Lysholm knee scoring scale after ACL reconstruction [12,13]. In India, [14] a case series of 25 patients who underwent ACL reconstruction for a year and were operated on by a single surgeon found that the mean preoperative Lysholm score was 58.8 (fair 56%; bad 44%). This increased to 91.2 after surgery (excellent 72%; good 24%). This was also higher than our findings. On the other hand, our

Table 2: Statistical difference between Lysholm and Tegner scores in relation to the clinical characteristics of patients with ACL injury (n= 60).

Factor	Lysholm score Mean ± SD	F/T-test; P value	Tegner score Mean ± SD	F/T-test; P value
Mode of injury[a]				
(i) Road traffic accident (RTA)/Falling	84.7 ± 4.93	F= 0.815; 0.448	4.67 ± 1.37	F= 1.214; 0.305
(ii) Contact sport	85.6 ± 3.54		5.05 ± 1.13	
(iii) Noncontact sport	84.4 ± 3.09		4.59 ± 0.95	
Dominant leg[b]				
(i) Right	84.9 ± 3.83	T= 0.048; 0.962	4.65 ± 1.11	T= -0.914; 0.365
(ii) Left	84.8 ± 3.06		4.89 ± 1.01	
Chief complaint[a]				
(i) Instability	85.2 ± 3.27	F= 1.804; 0.174	4.84 ± 0.92	F= 1.363; 0.264
(ii) Locking	86.0 ± 3.37		5.25 ± 1.50	
(iii) Both	83.3 ± 3.84		4.38 ± 1.33	
Duration between the injury and the surgery[a]				
(i) < 6 months	83.4 ± 3.29	F= 1.569; 0.217	4.38 ± 0.92	F= 1.794; 0.176
(ii) < 1 year	85.8 ± 3.21		5.09 ± 1.09	
(iii) > 1 year	84.6 ± 3.57		4.65 ± 1.05	
Types of rehabilitation[a]				
(i) Hospital rehab program	83.8 ± 2.95		4.40 ± 0.94	
(ii) Gym rehab	84.5 ± 2.91	F= 7.895;	4.73 ± 0.90	F= 7.233;
(iii) Both	86.5 ± 3.11	**<0.001****	5.27 ± 0.96	**<0.001****
(iv) None	78.7 ± 0.58		3.00 ± 0.00	
Duration of postoperative rehabilitation[a]				
(i) Less than one (1) month at the hospital	82.8 ± 2.79		4.08 ± 0.86	
(ii) More than two months at the hospital	85.6 ± 2.51		5.00 ± 0.82	
(iii) Less than one month at a gym	83.5 ± 3.54		4.50 ± 0.71	
(iv) More than two months at a gym	84.8 ± 2.95	F= 4.749; **0.001****	4.78 ± 0.97	F= 4.640; **0.001****
(v) Less than one month in both	86.3 ± 4.03		5.00 ± 0.82	
(vi) More than two months in both	86.5 ± 3.04		5.32 ± 0.99	
(vii) None	78.7 ± 0.58		3.00 ± 0.00	
Returning to the previous fitness level[b]				
(i) Yes	88.0 ± 2.47	T= 6.537; **<0.001****	5.80 ± 0.83	T = 7.317; **<0.001****
(ii) No	83.3 ± 2.72		4.25 ± 0.75	

Most authors use the terms statistically significant (P 0.05) and statistically highly significant (P 0.001). (Less one in a thousand chance of being wrong). The outcome is regarded as extremely significant.

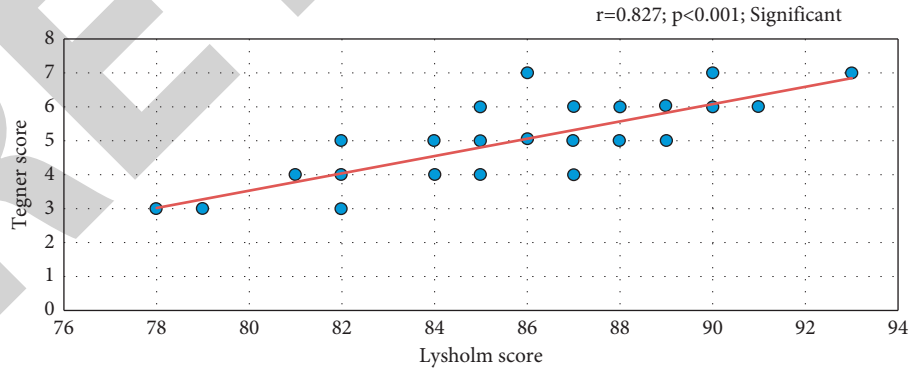

Figure 2: Correlation (Pearson-r) between Lysholm and Tegner scores.

findings are consistent with Devgan et al. [15] and Bangert and colleagues [16].(The average postoperative Lysholm score was 86 in both studies). The Tegner activity scale was another significant indicator for determining the patients' functional status. After six months of follow-up, the patients' mean Tegner score was 4.77 (1.06) out of 10 points. The Tegner score used in our study was consistently within the recorded range as defined by the literature [13, 15].

Patients who participated in both a hospital and gym rehab program for more than two months had a higher functional ability than those who participated in either a hospital rehab or a gym rehab program only. We also

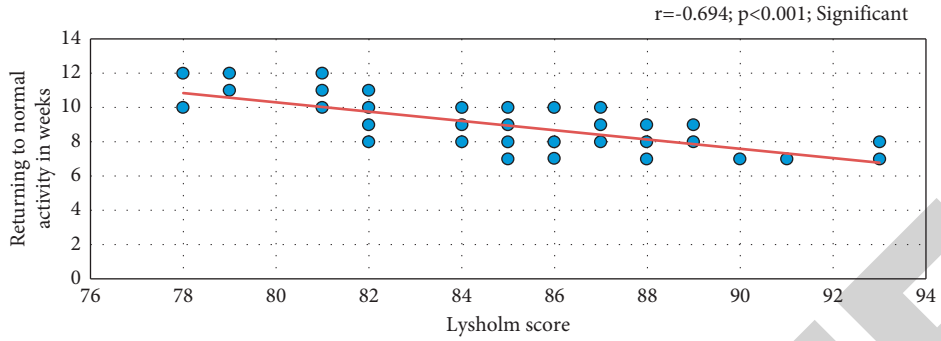

Figure 3: Correlation (Pearson's (R) between the Lysholm score and the time needed to return to normal daily activities (weeks).

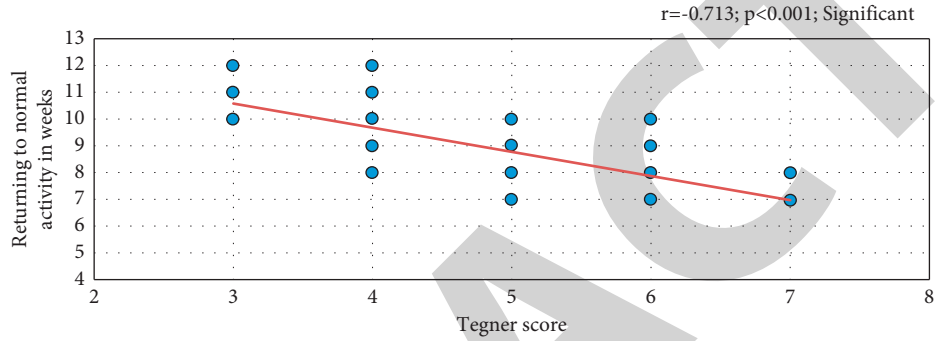

Figure 4: Correlation (Pearson's (R) between the Tegner score and the time needed to return to normal daily activities (weeks).

Table 3: Relationship between returning to the fitness level and the type of rehabilitation including rehabilitation duration (n= 60).

Factor	Returning to fitness level		X^2	P value[§]
	Yes N (%) (n=20)	No N (%) (n=40)		
Type of rehabilitation				
(i) Standard hospital rehab program	06 (30.0%)	14 (35.0%)	2.724	0.552
(ii) Gym rehab	03 (15.0%)	08 (20.0%)		
(iii) Both	11 (55.0%)	15 (37.5%)		
(iv) None	0	03 (07.5%)		
The duration of postoperative rehabilitation				
(i) Less than one month at the hospital	0	13 (32.5%)	18.711	**0.001****
(ii) More than two months at the hospital	06 (30.0%)	01 (02.5%)		
(iii) Less than one month at a gym	0	02 (05.0%)		
(iv) More than two months at a gym	03 (15.0%)	06 (15.0%)		
(v) Less than one month in both	02 (10.0%)	02 (05.0%)		
(vi) More than two months in both	09 (45.0%)	13 (32.5%)		
(vii) None	0	03 (07.5%)		

The result is considered highly significant if the P value is 0.001 or less.

discovered that patients who regained their health had a higher functional status than those who did not. We also observed that the association between Lysholm and Tegner scores was significantly higher (p= 0.001), thus implying that the Tegner score increased with the Lysholm score.

However, the association between Lysholm and Tegner scores in relation to time spent returning to normal daily life activities were highly inversely correlated (p= 0.001), implying that an increase in Tegner performance corresponds to a decrease in weeks spent returning to normal daily life activities. Furthermore, we found that the length of postoperative rehabilitation has a significant impact on returning to the fitness level (p= 0.001).

To the best of our knowledge, only a few articles have examined the impact of the Lysholm and Tegner scores on postsurgery patient characteristics.

These findings are a valuable addition to this study discipline's ongoing research. More than half of the subjects

(51.7%) had a duration of more than one year between the incident and the procedure, and these may be attributed to the fact that 53.3% of the cases involved noncontact sports. Shaikh et al. [12]stated that most cases had surgery within six months of the date of injury, which is shorter than our study. This is most likely because most cases recorded were as a result of a car accident that necessitated abrupt intervention or surgery.

According to Chodavarapu and associates [14], the most common presurgical concern was instability. This supports the findings of Devgan and colleagues [15] who found that patients experienced persistent knee pain and instability before arthroscopic assisted ACL reconstruction.

5. Conclusion

The Lysholm knee scoring scale and the Tegner activity scale show that arthroscopically assisted ACL reconstruction with a hamstring autograft has a successful functional outcome after rehabilitation. More than two months of regular postoperative recovery in both hospital and gym rehabilitation programs are a significant step in regaining fitness. The duration of postoperative recovery has a significant impact on resuming regular daily life activities and fitness levels.

Therefore, we first strongly emphasize preventing ACL injury by strength training of the quadriceps and hamstrings along with muscles and ligaments of the feet and ankles.

These prevention steps can prevent the pivoting or twisting that leads to ACL tears. We also recommend stretching and warming up these ligaments and muscles prior to any intense activities.

We further recommend educating patients with torn ACLs about the importance of having good strengthening and training programs (swimming and stationary bicycle exercises) before surgery. Surgery should be followed with extensive rehabilitation therapy at a hospital under supervision of a professional therapist after ACL reconstruction surgery. Finally, we recommend an exercise program that strengthens the whole lower limb muscles and ligaments, especially quadriceps, hamstring, ankles, and feet.

Data Availability

The datasets are available from the corresponding author either collected or analyzed during the current study on reasonable request and upon IRB approval.

Ethical Approval

The study was conducted in accordance with the Declaration of Helsinki and approved by the Institutional Review Board (Ethics Committee).

Consent

iInformed consent was obtained from all subjects involved in the study prior to study commencement.

Conflicts of Interest

The author declares no conflicts of interest.

Authors' Contributions

The author certifies that he has participated sufficiently in the work, including participation in the conceptualization, methodology, investigation, design, analysis, writing, and revision of the manuscript. The author accepts full responsibility for the work and the conduct of the study, and more; he has access to the data and controlled the decision to publish.

Acknowledgments

The author appreciates the efforts exerted by his trainees Dr.Mohammed Saleh and Dr.Abdulmajed who took the consents from the patients. He thanks Dr.Hasan Alghamdi for his valuable guidance and contribution in revising the manuscript.

References

[1] K. Briggs, M. S. Briggs, Kocher, Rodkey, and Steadman, "Reliability, validity, and responsiveness of the Lysholm knee score and tegner activity scale for patients with meniscal injury of the knee," *Journal of Bone and Joint Surgery American Volume*, vol. 88, no. 4, pp. 698–705, 2006.

[2] S. R. Filbay, Culvenor, Ackerman, Russell, and Crossley, "Quality of life in anterior cruciate ligament-deficient individuals: a systematic review and meta-analysis," *British Journal of Sports Medicine*, vol. 49, no. 16, pp. 1033–1041, 2015.

[3] K. Briggs, Lysholm, Tegner, Rodkey, Kocher, and Steadman, "The reliability, validity, and responsiveness of the Lysholm score and tegner activity scale for anterior cruciate ligament injuries of the knee," *The American Journal of Sports Medicine*, vol. 37, no. 5, pp. 890–897, 2009.

[4] A. Fältström, "Patient-reported knee function, quality of life, and activity level after bilateral anterior cruciate ligament injuries," *The American Journal of Sports Medicine*, vol. 41, no. 12, pp. 2805–2813, 2013.

[5] C. Y. Chee, Chen, Pearce et al., "Outcome of patellar tendon versus 4-strand hamstring tendon autografts for anterior cruciate ligament reconstruction: a systematic review and meta-analysis of prospective randomized trials," *Arthroscopy: The Journal of Arthroscopic & Related Surgery*, vol. 33, no. 2, pp. 450–463, 2017.

[6] R. B. Diermeier T, "Treatment after anterior cruciate ligament injury: panther symposium ACL treatment consensus group," *Orthop J Sports Med*, vol. 8, no. 6, pp. 2390–2402, 2020.

[7] E. T. Rose, Engel, Bernhard, Hepp, Josten, and Lill, "Differences in the rehabilitation period following two methods of anterior cruciate ligament replacement: semitendinosus/gracilis tendon vs. ligamentum patellae," *Knee Surgery, Sports Traumatology, Arthroscopy*, vol. 12, no. 3, pp. 189–197, 2004.

[8] A. G.-J. Harris Jd, "Return to sport after ACL reconstruction," *Orthopedics*, pp. 103–108, 2014.

[9] A Walker, Hing, Lorimer, and Rathbone, "Rehabilitation characteristics and patient barriers to and facilitators of ACL reconstruction rehabilitation: a cross-sectional survey," *Physical Therapy in Sport*, vol. 48, pp. 169–176, 2021.

Hindawi
Journal of Environmental and Public Health
Volume 2023, Article ID 9760232, 1 page
https://doi.org/10.1155/2023/9760232

Retraction

Retracted: The Practices of Solid Waste Utility and Thriving Conditions of Logistics (a Case of Tepi Town): A Study to Treat the Healthy Environment

Journal of Environmental and Public Health

Received 26 September 2023; Accepted 26 September 2023; Published 27 September 2023

This article has been retracted by Hindawi following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of one or more of the following indicators of systematic manipulation of the publication process:

(1) Discrepancies in scope

(2) Discrepancies in the description of the research reported

(3) Discrepancies between the availability of data and the research described

(4) Inappropriate citations

(5) Incoherent, meaningless and/or irrelevant content included in the article

(6) Peer-review manipulation

The presence of these indicators undermines our confidence in the integrity of the article's content and we cannot, therefore, vouch for its reliability. Please note that this notice is intended solely to alert readers that the content of this article is unreliable. We have not investigated whether authors were aware of or involved in the systematic manipulation of the publication process.

Wiley and Hindawi regrets that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our own Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

References

[1] N. Amare, O. Al-Bhadly, M. Birhan, S. Sulaiman Hamid, and A. A. H. Mohamad, "The Practices of Solid Waste Utility and Thriving Conditions of Logistics (a Case of Tepi Town): A Study to Treat the Healthy Environment," *Journal of Environmental and Public Health*, vol. 2022, Article ID 8391616, 5 pages, 2022.

Hindawi
Journal of Environmental and Public Health
Volume 2022, Article ID 8391616, 5 pages
https://doi.org/10.1155/2022/8391616

Research Article

The Practices of Solid Waste Utility and Thriving Conditions of Logistics (a Case of Tepi Town): A Study to Treat the Healthy Environment

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Received 4 June 2022; Revised 22 June 2022; Accepted 24 June 2022; Published 9 July 2022

Academic Editor: Sivakumar Pandian

Unwanted remains, discarded residues, and byproduct materials that are not required by the initial user are known as wastes. In Ethiopia, improper solid waste management becomes endemic and it affects the health conditions, comforts, and freedom of town communities. Improper solid waste management can also adversely affect infrastructure damages, socioeconomic conditions, and environmental and health problems. So, awareness creation among the communities is necessary. The main objective of the study was to assess the management of existing solid waste activities and reverse logistic systems in Tepi town. The impacts of improper solid waste management were reduced through waste accumulation, transportation, recycling, and waste removal. Available pieces of information for the study were gathered from 450 near house places and 549 survivals. The collected data were analyzed by using Vensim system dynamics software, and the obtained results were modeled by a system dynamic cause and effect relationship diagram. Finally, the appropriate recommendations for communities, municipals, and institutions were provided.

1. Introduction

Unwanted remains, discarded residues, and by-products of materials that are not required by the initial users are called wastes [1]. Governments are investing huge amounts of money and many countries are battling with waste management to tackle waste issues all over the world [2]. The rapid urbanization and population growth have a great effect on the municipal solid waste generation rate [3]. Independent and intensive explorations and research on municipal solid waste collections were conducted by developed countries, and they can reach an effective waste collection process with a performance rate of 100% [4]. Countries like China, Singapore, the Netherlands, and Sweden can also reduce waste through the concept of reuse and recycling with a performance rate of 25% [5]. Landfilling and burning management of solid wastes in Israel and Slovakia affect environmental health [6]. In urban centers, about 95% of the collected solid wastes were thrown away at dumping sites and less than 50% were collected [7].

In cities and towns of developing countries, solid waste management deficiencies were visible in many areas with little or no attention in those urban centers at all [8]. 30–50% of the generated urban center solid wastes of developing cities were thrown away on streets and open spaces causing serious health problems [9]. This is due to the lack of sufficient solid waste collection services [10]. In low-income countries, more than 50% of the collected solid wastes were

disposed of on uncontrolled landfilling and the collection rates reached about 70% [11]. Due to the concentration of industries, an urban population growth, the consumption of residents, and inadequate finance and facilities, the volume of waste was increased in urban areas of SNNPR [12]. In Tepi town, the generated solid wastes were thrown away on streets, unapproved dumpsites, in waterways (drainage systems), and at open sites near the residential areas affecting the environment [13].

Solid wastes that are carelessly disposed of and end up everywhere can poison and contaminate the world [14]. So, these contaminations can cause water, soil, and air pollution which leads to global warming [15]. The polluted water chemicals will damage plants and fish in lakes. Inadequately managed landfills may cause air and other environmental pollution across the world [16]. The health, well-being of residents in cities and towns of urban areas, and the environmental protections were kept by adequate solid waste facilities [17]. The town municipality's commitments and active involvements of the communities have a significant role in managing the solid wastes properly [18]. This study assessed the Tepi town's solid waste management adoption practices. If solid waste is not effectively managed, it hurts the environment and public health [19]. Otherwise, if it is managed properly, it can be a valuable resource [20]. This study assessed the contributing factors, the impacts, the role of the logistics process, and the improper management activities of the solid wastes in Tepi town.

The outcomes of the study help in developing solid waste management problem-solving policies for the local policymakers. It is also used for conducting a similar study at a regional level. Solid waste management improves the development and progress of any country [21]. However, this study shows that both the services and the practices of managing solid waste were poor at the household and municipality levels. Hence, solid waste management plans and strategies should be developed by the municipality of the town to improve the services, public awareness, public participation, and public involvement and to enforce the laws and regulations.

2. Objective

2.1. General Objective. The objective of the study is to search the solid waste management practices of Tepi town in three kebeles, reverse logistics of wastes, and waste disposals to reduce improper management of solid wastes and their impacts on health and the environment.

2.2. Specific Objectives. The specific objectives are as follows:

(i) To assess the existing practices of the solid waste management

(ii) To identify influencing factors for the improper management of the solid wastes

(iii) To investigate an improper solid waste management impact

(iv) To be aware of the role of logistics in the management activities of the solid wastes

3. Methodology

3.1. Study Area. Tepi is among the Ethiopian towns found in the southwest of Ethiopia at 621 km south of Addis Ababa on a latitude of 7°12′N, a longitude of 35°27, and an elevation of 1097 meters above mean sea level [22]. The town is well known for coffee and spice production [23]. Tepi town has three known kebeles: Hebert, Andenet, and Selam kebeles.

3.2. The Type of Research. Due to the nature of the study, mixed type of research was employed.

3.3. Data Sources and Data Collection. Primary data: from direct observation, existing dried and semiliquid dirt will be captured through the camera. An in-depth interview and the designed questionnaire were distributed to key informant respondents. The secondary data sources were referred to and collected from books, journals, and other unpublished research studies.

3.4. Sampling Size and Technique. The sample size determination formula is taken from the Cochran formula [24].

$N = (Z^2(pq))/e^2$, where N is the total number of directly effaceable population size, the margin error (e) is 0.03, the confidence level (Z) is 99%, and the target design will satisfy 85%. Stratified sampling targets will implement according to key informant groups.

3.5. Data Analysis and Presentation. System dynamics, Excel, and Microsoft word were used. Tables, graphs, and logical arguments by narration were utilized. From captured data in the community, the researcher recorded directly in Tepi town all kebeles as a sample. It is shown in Figure 1 for clarification.

4. Results and Discussion

The survey study design was conducted in the near house places of Tepi town. The required data were collected from 450 near house places and 549 respondent individuals of the three kebeles through a multistage sampling technique. Then, the collected data were analyzed by SPSS statistical analysis software. Bivariate and multivariate analyses were done to identification of the good practices of solid waste management predictors. The level of significance between determinant factors was assessed by using the odds ratio with a 90% confidence interval and p value < 0.05. A 92% response rate was achieved; 366 out of the 549 questionnaires sent out were returned. Descriptive statistics were used for reporting the analyzed results.

The outcomes of the study show that the management practices of solid waste in the majority of the households were poor. The age of the respondents was significantly correlated with the management practices of the household

Figure 1: Different kinds of sample wastes in Tepi town.

solid wastes in the study area. A second analysis was done by Vensim (system dynamics software), and the factors considered are community attitude, municipal commitment, intellectual contribution, phenomena, and lack of infrastructure in the town. The basic cause-effect relationship analysis was done using the following five factors. Those are solid waste quantity in Tepi town, dirt accumulation, dirt removal, waste management practices, reverse logistic system, kinds of businesses, and then finally wastage rate.

From Figure 2, it is possible to grasp the causes and root causes that affect the rate of the waste. Due to that, there is an impact on health and environmental pollution problems. The result implies that it is better to check and control the root causes rather than focusing on the effects. The study contributes to knowledge of the subjects of solid waste management outcomes. For data analysis and interpretation, the computations of the standard deviations and the means, together with the structural equation model, have also been used. From this study, the solid waste management practices were associated with homeownership, attitude, education level, and cleanup campaign participation. Therefore, continuous awareness creation companies and community-

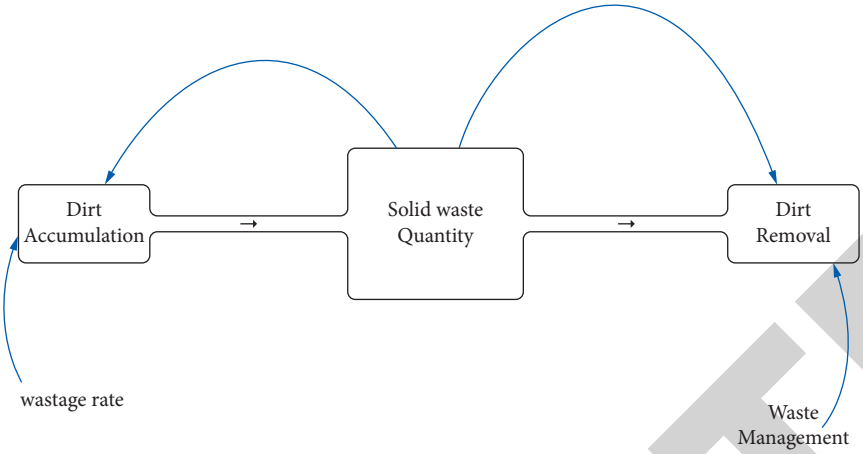

Figure 2: System dynamics model of the factors.

based programs were needed to increase the coverage of door-to-door collection services of the solid wastes and encourage the ability of recycling and proper solid waste disposal by the households.

5. Conclusion and Recommendation

In this study, the data were gathered from only one town (Tepi), the respondent responses may be biased, and the attitudes of the respondents may also be misinterpreted. So, those were the limitations of the study, and it is better to collect the data from different cities. In addition to this, the number of participants and the sample size were also not sufficient enough. In the future, it is better to call all stakeholders and shareholders to participate in both genders in an equal ratio better to take. In this research, no governmental support or environmental specialist was included. Since the current study was conducted during the recession-era, the results found on the suffering period may be different.

Last, it is better to use more variables than the variables that were included in this study to obtain a better result. So, it is recommended to conduct other vast and frequent longitudinal research and managerial support to Tepi town at the zonal level and woreda level.

Data Availability

The data used to support the results of this study are included within the article.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

References

[1] P. Tanskanen, "Management and recycling of electronic waste," *Acta Materialia*, vol. 61, no. 3, pp. 1001–1011, 2013.

[2] M. A. Berry and D. A. Rondinelli, "Proactive corporate environmental management: a new industrial revolution," *Academy of Management Perspectives*, vol. 12, no. 2, pp. 38–50, 1998.

[3] E. Achankeng, "Globalization, urbanization and municipal solid waste management in Africa," in *Proceedings of the African Studies Association of Australasia and the Pacific 26th Annual Conference*, pp. 1–22, Adelaide, Australia, 2003.

[4] A. Purwani, M. Hisjam, and W. Sutopo, "Municipal solid waste logistics management: a study on reverse logistics," *AIP Conference Proceedings*, vol. 2217, no. 1, Article ID 030181, 2020.

[5] I. C. Nnorom and O. Osibanjo, "Overview of electronic waste (e-waste) management practices and legislations, and their poor applications in the developing countries," *Resources, Conservation and Recycling*, vol. 52, no. 6, pp. 843–858, 2008.

[6] T. Karak, R. M. Bhagat, and P. Bhattacharyya, "Municipal solid waste generation, composition, and management: the world scenario," *Critical Reviews in Environmental Science and Technology*, vol. 42, no. 15, pp. 1509–1630, 2012.

[7] G. Alshammari, A. A. Hamad, Z. M. Abdullah et al., "Applications of deep learning on topographic images to improve the diagnosis for dynamic systems and unconstrained optimization," *Wireless Communications and Mobile Computing*, vol. 2021, Article ID 4672688, 7 pages, 2021.

[8] T. Ogwueleka, "Municipal solid waste characteristics and management in Nigeria," *Journal of Environmental Health Science and Engineering*, vol. 6, no. 3, pp. 173–180, 2009.

[9] E. Gelan, "Municipal solid waste management practices for achieving green architecture concepts in Addis Ababa, Ethiopia," *Technologies*, vol. 9, no. 3, p. 48, 2021.

[10] G. Lema, M. G. Mesfun, A. Eshete, and G. Abdeta, "Assessment of status of solid waste management in Asella town, Ethiopia," *BMC Public Health*, vol. 19, no. 1, p. 1261, 2019.

[11] M. Mourshed, M. H. Masud, F. Rashid, and M. U. H. Joardder, "Towards the effective plastic waste management in Bangladesh: a review," *Environmental Science & Pollution Research*, vol. 24, no. 35, pp. 27021–27046, 2017.

[12] A. Hasan Hameed, E. Annon Mousa, and A. Abdullah hamad, "Upper limit superior and lower limit inferior of soft sequences," *International Journal of Engineering & Technology*, vol. 7, p. 306, 2018.

[13] B. Mekonnen, A. Haddis, and W. Zeine, "Assessment of the effect of solid waste dumpsite on surrounding soil and river water quality in Tepi town, Southwest Ethiopia," *Journal of Environmental and Public Health*, vol. 2020, p. 9, 2020.

Hindawi
Journal of Environmental and Public Health
Volume 2023, Article ID 9828903, 1 page
https://doi.org/10.1155/2023/9828903

Retraction

Retracted: Research on Mental Health Status of College Chinese Learners from the Perspective of Sustainable Development of Ecological Environment

Journal of Environmental and Public Health

Received 27 June 2023; Accepted 27 June 2023; Published 28 June 2023

This article has been retracted by Hindawi following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of one or more of the following indicators of systematic manipulation of the publication process:

(1) Discrepancies in scope
(2) Discrepancies in the description of the research reported
(3) Discrepancies between the availability of data and the research described
(4) Inappropriate citations
(5) Incoherent, meaningless and/or irrelevant content included in the article
(6) Peer-review manipulation

The presence of these indicators undermines our confidence in the integrity of the article's content and we cannot, therefore, vouch for its reliability. Please note that this notice is intended solely to alert readers that the content of this article is unreliable. We have not investigated whether the authors were aware of or involved in the systematic manipulation of the publication process.

Wiley and Hindawi regrets that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our own Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

References

[1] Y. Liu and X. Jin, "Research on Mental Health Status of College Chinese Learners from the Perspective of Sustainable Development of Ecological Environment," *Journal of Environmental and Public Health*, vol. 2022, Article ID 6594651, 6 pages, 2022.

Hindawi
Journal of Environmental and Public Health
Volume 2022, Article ID 6594651, 6 pages
https://doi.org/10.1155/2022/6594651

Research Article

Research on Mental Health Status of College Chinese Learners from the Perspective of Sustainable Development of Ecological Environment

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Received 12 May 2022; Revised 25 May 2022; Accepted 6 June 2022; Published 6 July 2022

Academic Editor: Sivakumar Pandian

Ecologically sustainable development is the environmental basis of sustainable development. In order to realize ecological sustainable development, we need to study the mental health status of college Chinese learners under the principle of prevention. This study analyzes the correlation and cognition between college Chinese learners' mental health and their mental health status during the learning time through statistical methods and different personalities under various factors. The results show that the learners' mental health state in learning college Chinese is different, the percentage of different personalities under certain factors is different, the relevance and recognition in the learning process are indispensable, and the effect is often different in the length of the learning time, so it is of great significance to the learners' mental health state.

1. Introduction

As the most widely spread and used language in the world, Chinese occupies an important position in the language of international communication. In today's economic globalization, to strengthen the relations and exchanges between different countries and nationalities, we should strive to master Chinese as a communication tool, so as to meet the developmental requirements of the times. From the perspective of sustainable development, the mental health assessment of college Chinese learners needs to comply with the ecological development trend of education. Foreigners learning Chinese have different difficulties in the process of learning due to their different nationalities, languages, and cultures. When learning and contacting Chinese, many psychological problems will appear. The mental health of college Chinese learners is generally measured by the scale, and its standard is not fixed. The mental health standard changes with the changes of the times and cultural background. This calls on college Chinese learners to pay attention to their mental health. Ye Wanlin et al. pointed out that the use of learning strategies by Chinese learners in different learning stages are selective, and the use of the strategies develops nonlinearly in a certain time span. The use of language learning strategies changes with the situation of language problems and individual cognition, which provides an empirical basis for the intervention of Chinese learning strategies [1]. Pang Xian et al. analyzed the learning needs of Chinese learners of different nationalities, pointed out the basic situation of Chinese learners of different nationalities and their needs for Chinese learning, and put forward specific teaching suggestions to meet the needs of the times [2]. Xu Fang analyzed and studied the psychological characteristics of college students' Chinese learning, conducted psychological counseling and relief, and made corresponding measures to overcome the psychological obstacles of learners of Chinese, hoping to create a harmonious and relaxed classroom atmosphere, mobilize students' learning enthusiasm and participation consciousness, and pay attention to [3]. Chen Tian xu proposed the tendentious characteristics of college Chinese learners in learning styles, and carried out Chinese teaching according

to their characteristics, which has brought great practical significance and a reference value to education [4]. Zhou Hong rui et al. proposed that in the process of learning Chinese, it is necessary to analyze learners' learning motivation because it will directly affect the effect of learners' ability to learn Chinese, promote learners to have more clear goals in Chinese learning, stimulate learning enthusiasm, and let learners learn Chinese to the greatest extent [5]. China has a civilization history of more than 5000 years, of which the history of the development of writing is more than 3700 years. Foreigners are also deeply attracted by these historical cultures. We should understand and inherit Chinese culture. Learning Chinese is helpful for learners to have a more comprehensive understanding of Chinese history, including Chinese politics, economy, culture, and customs. Li Su jun analyzed the differences in the learning motivation of learners of different nationalities, different forms of learning, and different ages. When learning Chinese at different ages, the initial learning motivation will be different, and there will be differences in the form of learning [6]. He Shan investigated the language anxiety of foreign learners in the process of Chinese learning and use, and specifically analyzed their Chinese learning anxiety in different environments and situations, as well as their fear of other people's negative evaluation and their negative evaluation of Chinese [7]. Yang Xiao bin discussed learners' motivation to learn Chinese. The strong practicability of Chinese is their primary motivation to learn Chinese. In the process of learning Chinese, let learners be in an interesting atmosphere, bring out learners' points of interest, guide them to challenge difficulties in learning Chinese, and make them sincerely willing to learn Chinese [8]. Therefore, in the overall design of the teaching scheme, we should pay attention to the needs of learners, to the analysis of the learning situation, understand the basis of the learners, predict possible learning difficulties, pay attention to the general psychological needs of adult students, pay attention to the provision of nonteaching support services, and intelligently use online platforms to achieve effective complementarity. This study uses statistical methods to deeply study the mental health status of college Chinese learners. Through the comprehensive evaluation of college Chinese learners' mental health from the perspective of sustainable development, we can provide sustainable Chinese learners' mental health education and face up to maintaining the mental health of Chinese learners.

2. Analysis of the Current Situation of College Chinese Learners from the Perspective of Sustainable Development

In the rapid period of economic development, the economic market has gradually become internationalized and diversified, highlighting the importance of Chinese. When more and more learners choose a language, the proportion of English and Chinese has always been in the forefront. College Chinese learners have mental health problems under the multiple pressures of study, life, emotion, and employment. When learners use Chinese, they have fear, anxiety, and depression which should be relieved in time, and attention should be paid to the mental health of college Chinese learners. The problems of different college Chinese learners in the process of learning are becoming more and more prominent, so as to improve the efficiency of learners in learning Chinese. The choices of college learners in different languages are shown in Figure 1:

Figure 1 shows the proportion of college learners in different languages. It can be directly seen from the data that English accounts for most among the languages selected by college learners, followed by Chinese. The proportion of other relevant languages such as French, German, Russian, and Spanish has significantly decreased. Therefore, college Chinese learners should pay more attention to the skills of learning Chinese in the process of learning Chinese. At the same time, we should also strengthen the evaluation of college Chinese learners' mental health.

3. Analysis of Mental Health Status of College Chinese Learners

The psychological state of college Chinese learners is closely related to the perspective of sustainable development of the ecological environment. In the process of Chinese language teaching, many teachers put the focus of teaching on the curriculum, while ignoring the cultivation of students' correct learning concepts. But in fact, the most important thing in learning is students' learning attitude and learning methods. As long as these are correct and reasonable, students' professional course learning will naturally achieve good results. Chinese learners should calmly deal with their emotions in the process of adjusting their mental health state, and improve their interest in Chinese. Only when they have the emotion of learning Chinese can they have the learning motivation and behavior of actively wanting to learn. When they achieve certain learning results, it can promote the improvement of learners' self-learning awareness, strengthen learners' active learning behavior, produce good learning results, and further form a good cycle. However, due to the breadth and depth of the Chinese language, learners will encounter various difficulties and troubles when contacting and learning Chinese, which has made the psychological problems of College Chinese learners very prominent, such as the problems of environmental change and psychological adaptation, the psychological problems caused by improper psychological debugging of learning, difficulty in controlling emotions, relatively weak willpower, increased academic pressure, and interpersonal factors will bring a heavy psychological burden. Therefore, college Chinese learners should also be aware of the importance of mental health. To face the anxiety brought by learning Chinese, they need to accept it psychologically in a social and cultural atmosphere. They should affirm that the teachers' supporting behavior plays a key role in learning Chinese. Therefore, adding teachers' supporting behavior can change the psychological state of Chinese learners and improve their anxiety in learning Chinese psychological adaptation and sociocultural adaptation to

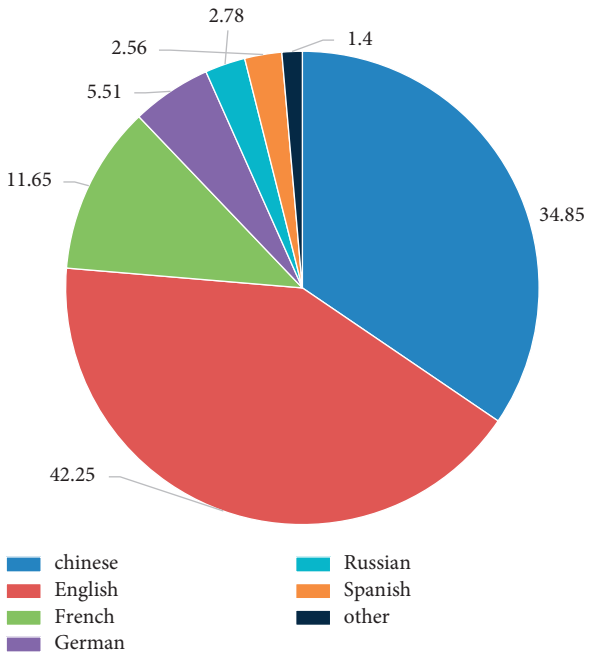

Figure 1: Proportion of college learners in different languages (%).

improve college learners' skills in learning Chinese. Without these basic support, we cannot find and use scientific learning methods and effective learning strategies. In the process of interpersonal communication, it is easy to produce psychological instability. To improve the ability of Chinese learners from the perspective of sustainable development of the ecological environment, they can face and deal with difficulties and challenges in life and learning peacefully.

4. The Psychological Influence of Different Personalities on the Learning Time and the Correlation and Cognition in the Learning Process

4.1. Recognition of Different Personalities in Each Learning Process. Learners' cognitive style is generally formed and developed by the influence of learning conditions, environment, personal endowment, and quality in the process of learning. Therefore, everything depends on our cognition and grasp of psychological laws. Without these basic support, scientific learning methods and efficient learning strategies cannot be found and used. Character is a specific psychological and behavioral way that people show things in social reality. It is the most important personality structural feature of people. A person's character cultivation includes congenital factors and acquired factors. On the basis of congenital character, the acquired character is shaped, and the two promote each other to form a complete character [9]. Different personalities can show a person's psychological outlook and reflect the psychological differences between individuals overnight. Therefore, they are in different states and degrees of absorption in the recognition of different personalities. Now, we analyze the psychological adaptation, social and cultural adaptation, and teacher support behavior of Chinese learners with different personalities in the process of learning, as shown in Table 1:

In Table 1, it is obvious from the data that the percentage of independent learners in the learning process has reached more than 60%, which is in obvious contrast with impulsive learners, while thoughtful and prone learners are in a stable state without significant fluctuation.

In order to better compare Chinese learners with different types of personalities, the following Figure 2 is obtained by visualizing the data in Table 1:

As shown in Figure 2, we can clearly see the contrast between different personalities and psychological adaptation, social and cultural adaptation, and teacher support behavior in the learning process. Learners with independent personalities have advantages and a strong acceptance ability in all aspects, while impulsive learners are in a downward trend in the learning process. Therefore, different personalities account for an important part in order to improve learners' understanding in the learning process and play a key role.

4.2. The Relevance between Learners in the Learning Process. One of the basic characteristics of learning is individuality. In order not to affect the cognitive structure formed by education and its natural behavior, we must improve learners' learning efficiency and constantly improve and update the correlation between our cognition. The relevance between knowledge can effectively promote learners' learning motivation and interest in the learning process, so that learners can easily be more interested in enjoying the relevance in the learning process. Learning itself is a cognitive structure of individual learners based on themselves, which is composed of a variety of factors. There is an indispensable correlation between them. They all influence each other. According to the correlation between learners, we get the following Figure 3:

As shown in Figure 3, it can be clearly seen that learners' personal factors affect language input and interaction, and interpersonal factors, and these two factors jointly affect learners' learning process and their degree of identity. The degree of identity is also affected by the learning environment. No matter what kind of factors exist, they affect and correlate with each other.

4.3. The Influence of Chinese Learning Time on Learners' Psychology. Learners with different mother tongue backgrounds and learning environments have different learning concepts in the learning time. Many ethnic minorities often do not have the ideal time for learning college Chinese due to factors such as environment and learning, which will cause depression, high ratings, anxiety, and pressure in psychology. Some learners do not have enough confidence in themselves. In the process of learning, anxiety psychology will affect learners' length of learning time and have a certain impact, so they cannot study quietly. The longer the learning time, the more serious the impact on psychology. In view of this problem, this paper studies the impact of the change of

Table 1: Comparison of cognition of Chinese learners with different personalities in the learning process.

	Psychological adaptation	Sociocultural adaptation	Teacher support behaviour
Independent type	69.15	66.89	60.23
Contemplative type	65.23	59.45	63.21
Impulsive type	42.36	51.3	48.96
Prone type	48.63	47.92	46.03

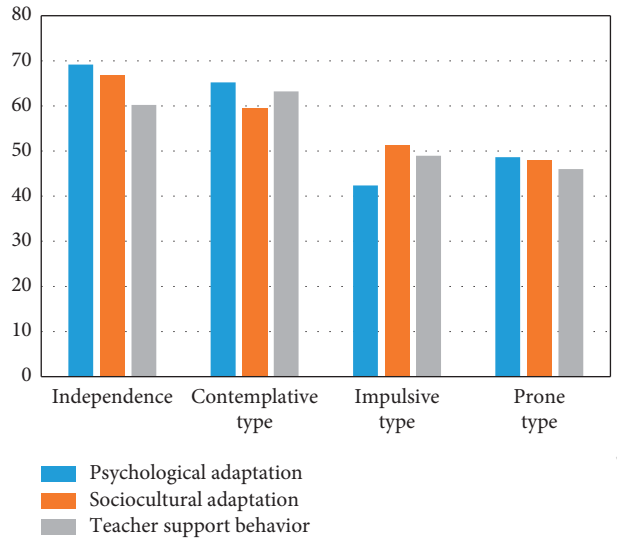

Figure 2: Visual map of cognition of Chinese learners with different personalities in the learning process.

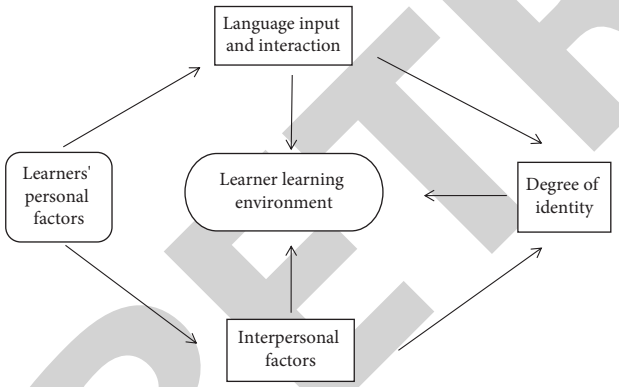

Figure 3: Correlation diagram of learners under different factors.

the learning time on learners' psychology, and carries out depression rating and anxiety rating on their psychology. Through the analysis of learners' learning time, the following Table 2 is obtained:

In Table 2, it can be seen that learners have higher scores on depression rating and anxiety rating without learning, while they have lower scores at two hours after one hour of learning, but the scores on depression rating and anxiety rating have increased after four hours. Therefore, it can be seen that learning a piece of knowledge for a long time affects mental health and makes people depressed.

In order to better compare the impact of learning Chinese on mental health, visual analysis is carried out according to the data in Table 2, and the following Figure 4 is obtained:

As shown in Figure 4, it can be seen that according to the change of learners' learning time, within 1–3 hours of learning, the ratings of the two kinds of psychology are in a downward trend, while for more than 3 hours, the depression rating and anxiety rating have an upward trend. Therefore, it can be concluded that the best learning state is within 3 hours, which can effectively memorize and reduce the psychological impact caused by learning.

5. Discussion

The influence of Chinese learning motivation on college Chinese learners' autonomous learning of Chinese has become particularly important, which helps to improve learning motivation, improve autonomous learning level, and achieve the purpose of efficient learning. At the same time, it is also necessary to stimulate college Chinese learners' learning motivation and improve their autonomous learning ability and behavior. College Chinese learners show varying degrees of anxiety and depression in their psychological adaptation. College Chinese learners will have different degrees of difficulties in social and cultural adaptation, so that college Chinese learners can receive different degrees of teacher support, improve the acceptance ability of Chinese learners in teacher support behavior, spread spiritual understanding in a good learning environment, and play a substantive guiding role. Whether at home or abroad, teaching Chinese as a foreign language must follow the law of foreign language teaching, that is, pay attention to the positive and negative transfer of the mother tongue to Chinese learning. Therefore, in teaching Chinese as a foreign language, the following problems are worth discussing. Wang Yuan et al. discussed the impact of teachers' autonomous support perceived by students on the students' autonomous learning behavior, and the intermediary role of psychological need, satisfaction, and autonomous motivation between them [10]. He Tengfei et al. discussed that social support from families will fit the results of social and cultural adaptation, and the potential regulatory role of social support in interpersonal relationships will increase the positive impact of social and cultural adaptation and improve learners' cultural adaptation ability [11]. Zhang Xiaotian discussed the widespread psychological anxiety of college students and analyzed various causes of anxiety. Learners should actively take a variety of countermeasures to change the current situation and strive to overcome psychological anxiety [12]. Wen Wen et al. (2021), from the perspective of college Students' learning psychology, analyzed the factors affecting learners' learning psychological structure and correctly adjusted it and had a good psychological state, which was more conducive to guiding

Table 2: Analysis of the impact of the length of Chinese learning time on mental health.

	Psychological adaptation	Sociocultural adaptation	Teacher support behaviour
Independence	69.15	66.89	60.23
Contemplative type	65.23	59.45	63.21
Impulsive type	42.36	51.3	48.96
Prone type	48.63	47.92	46.03

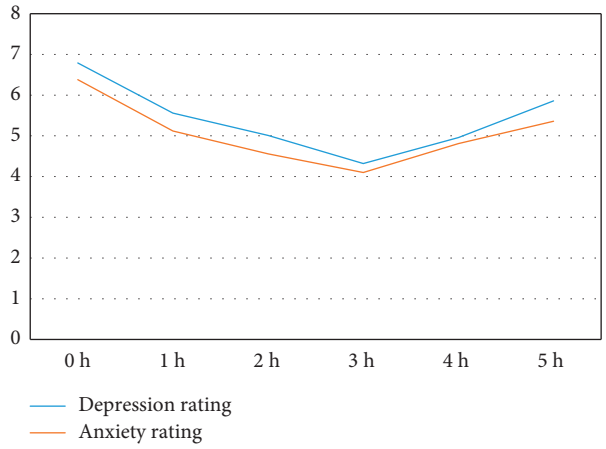

Figure 4: Visual diagram of the impact of learning Chinese on mental health.

learners to establish a correct world outlook, outlook on life, and values [13].

6. Summary

Based on the perspective of sustainable development of the ecological environment, this study studies the mental health status of college Chinese learners and analyzes the psychological impact of different personality learners on psychological adaptation, social and cultural adaptation, teacher support behavior, relevance between learners in the learning process, and the length of time learners spend learning college Chinese. The learners with an independent personality account for a high proportion of psychological quality under various factors, and the correlation between learning factors is indispensable. In terms of time, the time for learners to learn college Chinese is the best within 3 hours. This has significant research characteristics for future learners in personality, learning time, and learning factors. Learners should increase their own psychological flexibility, change their fear of difficulties and pressure, correctly understand mental health problems, treat learning problems with a positive attitude, establish the confidence to overcome pressure, develop themselves, and form the will quality of self-esteem, self-confidence, and self-reliance. Therefore, it is more important to keep the relationship between the changes of learners' mental health in the learning process, so that learners can grow modern high-quality talents with free and all-round physical and mental development in the learning process, and contribute their own value to the great rejuvenation of the Chinese nation.

Data Availability

The data underlying the results presented in the study are available within the article.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

Acknowledgments

This research was funded by the On-Campus Youth Fund of Northeast Normal University under Grant No. 1809222 and the Jilin Provincial Fund for Educational Science under Grant No. 1805313. Project of Jilin Provincial Department of Education (Project No.: 2005209).

References

[1] Y. W. lin and T. D. liang, "Dynamic selection and development of second language Chinese learning strategies: a longitudinal study," *Journal of Nanjing Normal University (SOCIAL SCIENCE EDITION)*, vol. 17, no. 02, pp. 65–75, 2022.

[2] P. Xian, "Zhao Xiao bing Analysis of Chinese learning needs of Myanmar migrant workers in Ruili, Yunnan," *Journal of Chuxiong Normal University*, vol. 37, no. 01, pp. 39–45, 2022.

[3] X. Fang, "Research and Analysis on the psychology of ethnic minority preparatory students learning Chinese in Colleges and universities in Xinjiang—Taking the preparatory students of Xinjiang Medical University as an example," *Journal of Jiamusi Vocational College*, vol. 9, no. 06, pp. 311–324, 2015.

[4] C. T. xu, "A study on the learning style tendency of Chinese learners in American Universities—Taking the University of South Carolina and Georgia State University as examples," *Comparative Education Research*, vol. 37, no. 12, pp. 16–23, 2015.

[5] Z. H. Rui and S. Yang, "A study on the motivation of foreign Chinese Learners," *Literature Education*, vol. 13, no. 10, pp. 166-167, 2021.

[6] L. S. Jun, "Differences in Chinese learning motivation and stimulating strategies of foreign students—a case study of central south university for nationalities," *Journal of Hubei University of Economics (HUMANITIES AND SOCIAL SCIENCES)*, vol. 14, no. 04, pp. 122–124, 2017.

[7] S. He, "A study on Chinese learning anxiety of foreign students," *Journal of Yunnan Normal University (Teaching and research of Chinese as a foreign language)*, vol. 12, no. 02, pp. 61–69, 2014.

[8] Y. Xiao, "A study on Chinese learning motivation of foreign students—a case study of Chinese learners in Brazil," *Journal of Wuhan University of Technology (SOCIAL SCIENCE EDITION)*, vol. 30, no. 02, pp. 156–160, 2017.

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Journal of Environmental and Public Health
Volume 2023, Article ID 9753570, 1 page
https://doi.org/10.1155/2023/9753570

Retraction

Retracted: Logic and Three Wheel Drive Analysis from New Urbanization to URI and Rural Revitalization under the Background of Ecological Environment Sustainability

Journal of Environmental and Public Health

Received 27 June 2023; Accepted 27 June 2023; Published 28 June 2023

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Wiley and Hindawi regrets that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our own Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

References

[1] H. Guo, "Logic and Three Wheel Drive Analysis from New Urbanization to URI and Rural Revitalization under the Background of Ecological Environment Sustainability," *Journal of Environmental and Public Health*, vol. 2022, Article ID 3085446, 7 pages, 2022.

Hindawi
Journal of Environmental and Public Health
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https://doi.org/10.1155/2022/3085446

Research Article

Logic and Three Wheel Drive Analysis from New Urbanization to URI and Rural Revitalization under the Background of Ecological Environment Sustainability

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Received 8 April 2022; Revised 27 April 2022; Accepted 5 May 2022; Published 29 June 2022

Academic Editor: Sivakumar Pandian

In order to explore the new urban-rural relationship (URR), develop urban-rural integration (URI), and realize rural revitalization (RRT), we should break down the barriers between developed cities and backward villages, and gradually realize the flow of production and optimize the combination, promote the coordinated development of rural and urban; this study analyzes the logic and three wheel drive from new urbanization to URI and RRT under the background of ecological environment sustainability, constructs a three wheel transmission model of rural economic development under the mode of URI, collects data through social survey, and analyzes the correlation of data by using the Spearman formula, using the curve estimation formula to analyze the data consistency, and explores the relationship between ecological environment investment and URI and RRT. Through continuous development, the gap between urban and rural areas has been significantly reduced, and major progress has been made in urban planning, construction, and management, and the rate of urban-rural integration has steadily increased, accelerating the pace of urban-rural integration.

1. Introduction

As the economy develops, China's urbanization has greatly improved, the new urbanization has also achieved remarkable results, and the level of agricultural transfer population integrated into the city has also improved, but there is a big gap between urban and rural (UAR) development [1]. To reduce the urban-rural gap (URG), it is necessary to promote the process of urban-rural integration (URI) under the background of new urbanization and rural revitalization strategy (RRS). The 19th National Congress pointed out" implement the RRS" and "establish and improve the institutional mechanism and policy system of URI development" [2]. This requires the relevant departments to implement a people-centered strategy to raise the level of urban construction, promote the urbanization of rural areas, accelerate the integrated development of rural and urban areas, vigorously build low-carbon green cities while realizing rural revitalization (RRT), establish new urban-rural relations, improve both UAR economic development, and promote the stable development of China's social economy [3].

Chen et al. (2022) calculated the development level of new urbanization and rural revitalization (NURR) in Heze and Liaocheng, Shandong Province, analyzed the coupling and coordination between the two, and constructed the evaluation index system (EIS) of NURR, so as to provide theory and basis for URI and urban-rural development (URD) strategy [4]. Ma (2022) studied the strategic deployment of the coordinated promotion of NURR from the three aspects of theoretical principles, structural models, and institutional mechanisms, focused on promoting the comprehensive integration of urban-rural relations (URR), and opened up the situation of the joint promotion of RRT and new urbanization [5]. Zhao (2022) analyzed Shanxi Province in research, constructed the EIS of NURR based on URI, analyzed its coupling and co dispatching mode. The article proposed strategies such as strengthening urban-rural mobility, cultivating scientific and technological innovation

power, and building small towns, which provided guidance for the development of URI [6]. Pan (2021) analyzed the path of NURR integrated development and believed that it is necessary to start from five aspects: dredge the UAR population flow channel, build a new pattern of urbanization space, improve rural infrastructure, promote farmers' nearby employment, and promote the integrated development of UAR culture, so as to realize the common development and common promotion of NURR [7]. Li et al. (2021) pointed out in their research that an important way to reshape the URR and promote the development of URI is to carry out NURR's "two wheel drive" strategy, which can improve the quality of URI development, improve the living standards of urban and rural residents, and achieve URI goals [8]. Su (2020) made a theoretical and logical analysis of NURR linkage in their research and thought that if you want to realize URI, we need to realize "university urbanization" and "rural industry prosperity" through modern industrial development, realize "green urbanization" and "rural ecological livable" through ecological civilization construction, and realize "humanistic urbanization" and "rural style civilization" through cultural inheritance, "Good governance urbanization" and "effective rural governance" are realized through social governance, and "inclusive urbanization" and "rich rural life" are realized through public service supply [9].

This study constructs a three wheel driving force development model of rural economy under URI mode and discusses the relationship between ecological environment investment and URI and RRT.

2. Related Concepts and Literature Review

2.1. New Urbanization and URI. China has been committed to rural development since the founding of the party and has accumulated experience and made achievements in the construction of urbanization. However, during the reform and opening up period, during the transformation to a modern society, cities, and towns are used as industrial carriers to accumulate capital, so financial, material, and technological resources are concentrated in the urban sector. This development strategy forms of the URG development, causing the rural development lags behind. With the development of society and economy, various contradictions appear, which brings a bad impact on sustainable development [10]. Since the twenty-first century, China has further developed URI on the basis of URI strategy. URI development can reshape URR, promote the linkage between new NURR Strategy, and accelerate the realization of rural modernization [11].

2.2. RRT Project. The RRT project is a strategic plan clearly put forward by the state in the 19th CPC National Congress. It constructs a national new national rural system in accordance with different industrial systems, production system, and operation system in rural areas. Rural is a regional complex with natural, social, production, life, ecological, and economic characteristics in China. It also has a number of other useful functions: 1. The space is broader and more suitable for human habitation and production. 2. Closer to nature, whether it is production or life, are in close contact with nature. 3. Ensuring the food is fresh, most of the ingredients are grown in rural areas, can be picked directly edible. 4. Fresh air is good for your mood. It is an important space for the activities of rural residents. Different industrial chains, such as agro-processing and tourism, can be established according to different features and functions. At present, the key development between people's needs for future life and economic imbalance is clearly reflected in China's countryside, and the characteristics of the important stage of socialist development also depend on the countryside. In analyzing the application research of RRT strategy, therefore, comprehensively carrying out the construction of RRT project can enhance the innovation and competitiveness of China's rural industry, and then improve the comprehensive benefits of RRT.

2.3. Ecological Sustainable Development. Ecological sustainable development is the rational utilization of environmental, ecological, and other natural resources on the basis of sustainable development. In the process of ecological sustainable development, we should not only effectively control and control social environmental protection and environmental pollution but also protect the balance of ecological environment and biodiversity. Building ecological sustainable development is related to the vital interests of each of us and the sustainable development of the whole country.

3. Development Model of Rural Economy under the Mode of Urban-Rural Integration

3.1. Three Wheel Driving Force of Rural Economic Development. The development of rural economy under the new situation requires the rational use of limited resources to realize agricultural industrialization, and further enhance the comprehensive competitiveness of rural economy. Combined with the actual situation, rural development can start from three aspects: planting, processing industry, and sales and circulation industry to generate three wheel driving force and form flywheel effects.

Planting, processing industry, and sales and circulation industry are the fundamental of rural economic development. To effectively promote rural economic development, drive farmers to increase income and get rich, narrow the gap between urban and rural areas, vigorous development of these three industries is essential.

3.2. Three Round Transmission Model of Rural Economy. In the three-wheel transmission-drive transmission analysis of the rural economy, in order to realize a better strategic transformation mode of rural economy from now on, it is necessary to analyze the flywheel effect, and its calculation formula is shown as follows:

$$Y = \tau \cdot \sum_{i\varepsilon n} X_i - \lambda, \tag{1}$$

where X_i: the ith data of the input data; n: total input data; τ: slope adjustment coefficient; λ: intercept adjustment coefficient; and Y: output data.

4. Social Survey and Statistical Methods

4.1. Social Survey and Data Sources. The objective data come from the actual operation test results of the simulation software of the above algorithm on the MATLAB simulation platform. The subjective data come from the subjective evaluation result data in the real person evaluation experiment;

4.2. Data Correlation Analysis Based on the Spearman Formula. In the three-wheel drive analysis of the logical road data from new urbanization to URI and RRT, it is necessary to use the Spearman formula calculated by the correlation coefficient analysis of two columns of variables, as shown in formula:

$$\rho_s = \frac{\sum_{i=1}^{N} (R_i - \overline{R})(S_i - \overline{S})}{\left[\sum_{i=1}^{N} (R_i - \overline{R})^2 \sum_{i=1}^{N} (S_I - \overline{S})^2\right]^{1/2}}, \tag{2}$$

where R_i and S_i are the grades of observed values, respectively; N is the total number of observations.

4.3. Data Consistency Analysis Based on Curve Estimation. The square of the correlation coefficient in the data correlation is also called the determination coefficient, and the size of the determination coefficient also determines the closeness of the correlation, that is, the goodness of fit of the correlation data analysis. The R2 formula algorithm for estimating the determination coefficient of the nonlinear curve is shown in formula:

$$R^2 = \frac{\sum_i (x_i - \overline{x})}{\sum_i (x_i - \widetilde{x}_i)}, \overline{x} = \frac{1}{n} \sum_{i=1}^{n} x_i, \tag{3}$$

where x_i is the ith input value in the sequence; $\overline{x}$ is the arithmetic mean of the investigated sample sequence; and N is the number of investigation samples.

5. Social Survey Results and Discussion

5.1. Correlation Analysis between Ecological Environment Investment and RRT. The development of RRT has always been the focus of the party and the government. In the rapid development of rural economy, China has proposed to take "production development, rural civilization, rural cleanliness, and management democracy" as the goal of new rural construction, and actively develop the rural economy, to realize the healthy development of rural areas. The key to RRT and development is to comprehensively implement the coordinated development of rural regional economic imbalance. Wang (2021) said in the analysis of the coordinated development of rural regional economy in the context of the rural revitalization strategy that under the high-speed development of our country's social economy, the economy of each region is constantly developing, the economy of rural areas is an important part of the overall development of our country, but due to the current unbalanced economic development of rural areas in our country, the state has put forward the implementation of the rural revitalization strategy; the relative measures of coordinated economic development in rural areas are put forward to solve the imbalance of rural economic development and provide a good opportunity for rural economic development. Reference [12]. At present, although under the promotion of precision poverty alleviation and the development of agriculture through science and technology, we have strengthened our efforts to lift ourselves out of poverty by applying science and technology specifically to agriculture, rural areas, and farmers, solving the practical problems in agriculture, rural areas, and farmers, and increasing the income of farmers; however, there are still some problems such as unbalanced development, irrational rural industrial structure, ineffective policies, and lack of relevant professionals. If we want to solve the problems facing the rural economy effectively, we should analyze and study the different evaluation factors that affect the development degree of the rural economy, so as to promote the uncoordinated development of the rural economy under the current policy guidance and promote the rural economic growth. While promoting rural regional economic growth, rural ecological environment governance has also been affected by a series of factors. Compared with cities, the efficiency of rural eco-environmental governance is also low, and the promotion and application of policies and funds are relatively backward. Moreover, the efficiency of rural eco-environmental governance is closely related to the degree of regional economic development, the quality of natural resources, and the technical level of eco-environmental governance in different industries. There is still a lot of room for rural environmental governance to improve. The 19th National Congress clearly proposed that in the RRS, we must ensure the rural ecological environment and promote the green and sustainable development of the rural environment. The evaluation factors affecting RRT development and rural ecological environment are now studied, as shown in Figure 1:

Figure 1 shows the growth value of the primary industry of rural regional economy and the proportion of funds invested in rural ecological environment governance in RRT and development evaluation. Rural primary industry mainly refers to the planting, animal husbandry, aquaculture, forestry, and other related industries that mainly use natural forces, that is, they are mainly engaged in agricultural production activities, producing industrial raw materials or products that can be consumed without deep processing. It is obvious from Figure 1 that the investment of rural ecological environment fund is in direct proportion to GBD in the primary industry. With the increase of environmental investment, the economic growth value of the primary industry is also increasing.

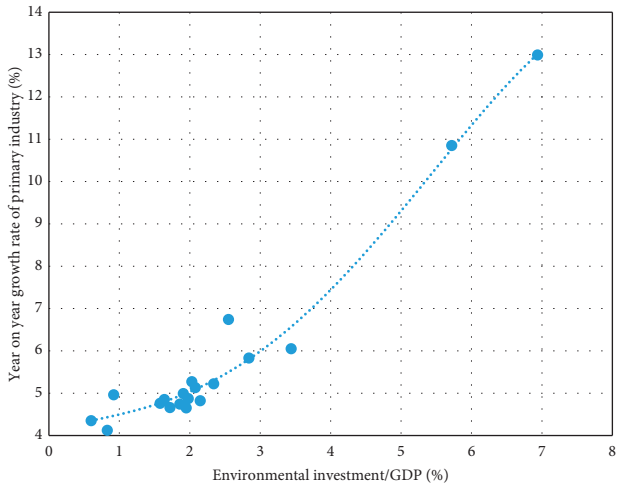

Figure 1: Proportion of GBD between environmental investment and primary industry.

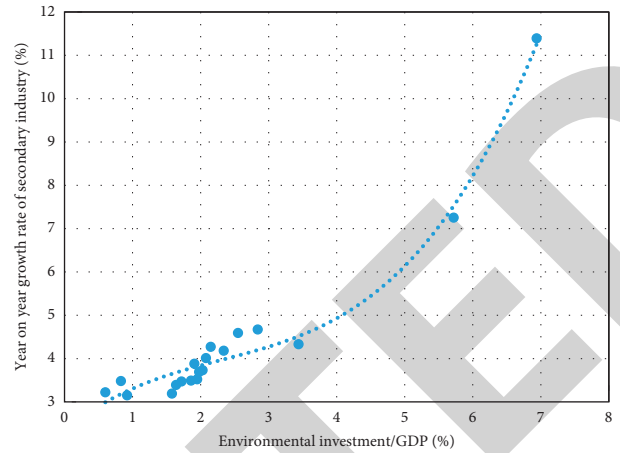

Figure 2: GBD proportion of environmental investment and secondary industry.

After entering the industrial society from agricultural production, it is the industrial production activities and manufacturing activities that process the products of the first industry, which have become the main economic activities of social reproduction. Industrial economics calls this economic activity the secondary industry. In the structural adjustment of rural industries, China's rural secondary industry mainly refers to the industrial and mining industries that drive rural economic growth. The development of the secondary industry also needs industrial extension and technological innovation on the basis of agriculture, integrate the functions of different industries in rural areas, develop new rural formats, and analyze the different impacts of rural secondary industry and environmental investment on local GBD, as shown in Figure 2:

Figure 2 shows the comparison between the growth value of the secondary industry and the investment of rural ecological environmental governance funds in RRT and development. From the dispersion degree and curve trend line of the above data, it can be seen that the GBD growth value of rural secondary industry at the same time, is also positively correlated with the gradual increase of environmental investment. It is considered that increasing rural eco-environmental investment can promote the development of RRT.

The tertiary industry mainly refers to the structure of circulation and service. At present, the vigorous development of the tertiary industry is also the inevitable trend of modernization. The industrial structure of most high-income countries is characterized by low primary industry, accounting for about 2%; The secondary industry is less than 30%; The tertiary industry is mostly higher than 70%. The development of China's primary and secondary industries has been greatly improved. However, the tertiary industry lags behind. It can be seen that there is still much room for the development of China's tertiary industry, especially China's service industry is in its infancy for the time being. Compared with developed countries, various regulations and systems of China's service industry are not perfect. It is also necessary to continuously focus on promoting the tertiary industry. This paper analyzes the correlation between different factors affecting the evaluation of RRT and development and the influencing factors of rural ecological environment, as shown in Figure 3:

Figure 3 shows the relationship between rural ecological environment investment and agricultural tertiary industry GBD. With the growth of the economic value of the tertiary industry, rural ecological environment investment is also increasing, and after the amount of capital investment reaches a certain degree, the economic value index of the region also increases significantly, which indirectly shows that increasing the investment of rural ecological environment funds can improve the overall regional economic growth of the countryside and then promote the new urbanization to the development of URI and RRT.

Observe and study the application development and continuous integration of rural primary industry, secondary industry, and tertiary industry in RRT, and analyze the corresponding correlation data between the three industries, as shown in Table 1.

Table 1 shows the comparison of correlation data values of three industries in rural development, and the determination coefficients R2 and Spearman of the primary industry in the correlation comparison ρ. The value of R^2 of the primary industry is the highest, followed by the secondary industry and the tertiary industry. The higher the value of R^2 and the closer the value of R^2 is to 1, it proves that the higher the consistency of correlation fitting between the two, the better it can promote the development of each other.

5.2. Correlation Analysis between Ecological Environment Investment and URI Development. The development optimization of RRT is also a new requirement for the evolution of urban-rural relations URR raised by the improvement of China's productivity level to a certain heigh. As China's productivity level has risen to a certain height, the gap between rural and urban development has become wider and wider. For

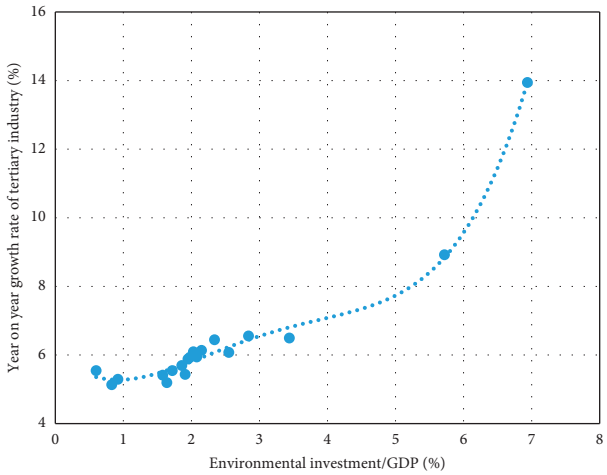

Figure 3: GBD proportion of environmental investment and tertiary industry.

Table 1: Correlation analysis and comparison between different industries.

Relevance	Coefficient of determination R^2	Spearman		
		P	ρ	P
Primary industry	0.903	0.004	0.912	0.005
Secondary industry	0.824	0.006	0.894	0.007
Tertiary industry	0.809	0.007	0.827	0.008

the problems between urban and rural development, it is necessary to gradually reduce or even eliminate the gap between urban and rural areas, the development and optimization of rural settlement of Ra is a new requirement for the evolution of urban-rural relations. Moreover, the characteristics of urban-rural development URD also have different forms in different stages of productivity development. Whether it is the "balance between urban and rural areas" at the beginning of the founding of new China, the "interactive development of urban and rural economy and society" after the reform and opening up and the "comprehensive integrated development of urban and rural areas" in the new era, it is an exploration of taking the road of integrated development of urban and rural areas with Chinese characteristics. Behind these phased evolution are the requirements for the development of economic productivity. We also need to further establish and improve the policy system and institutional mechanism for the integrated development of urban and rural areas, and increase the promotion of the level of industrial economy. When dealing with the relationship between "new urbanization" and "RRS", the report of the 19th National Congress also proposed that in the RRS, increasing the investment and governance of rural ecological environment and constructing the input-output system index of rural ecological environment governance can improve the efficiency of rural ecological environment management and improve the development level of regional economy. The correlation analysis of economic growth and environmental investment in different rural agriculture is shown in Figure 4:

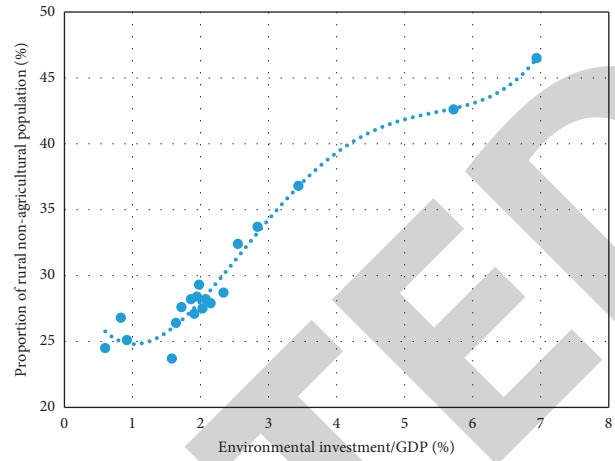

Figure 4: Proportion of environmental investment and nonagricultural population.

Figure 4 shows the evaluation of rural nonagricultural population for RRT and integrated development under the background of rural sustainable ecological environment. It is obvious from the node value of the data curve that the data value of rural nonagricultural population (NAP) is also not high when the investment of ecological environment funds is not high. When increasing investment in the ecological environment fund in the later stage, the number of rural nonagricultural population also increased significantly in this data node. It is considered that the number of rural NAP can be effectively increased by increasing the proportion of funds for ecological environment.

In order to better observe the impact and correlation of different regional economies of rural ecological environment, the proportion of non-agricultural population economy in rural economy in RRT and integration is analyzed and studied, as shown in Figure 5:

Figure 5 shows the relevant proportion of rural non-agricultural population rural NAP economy in a rural economy in rural integrated development under the background of sustainable ecological environment. The dispersion degree and curve trend of data show that the investment of ecological environment funds is positively correlated with the increase of the rural NAP economy, which can promote each other's development.

Under the background of sustainable ecological environment, the correlation data between the proportion of rural NAP and the economic proportion of rural NAP in the integration process from new urbanization to URI and RRT are observed, studied, and analyzed, as shown in Table 2:

Table 2 shows the correlation between the proportion of the nonagricultural population and the economic proportion of the nonagricultural population in RRT and development. It is found that the determination coefficients R^2 and Spearman ρ, the data values are close to 1, and the correlation between them is very significant. It is considered that it can promote the correlation development between rural ecological environment and urban-rural integration. It also provides a more effective economic driving force for the development of RRT.

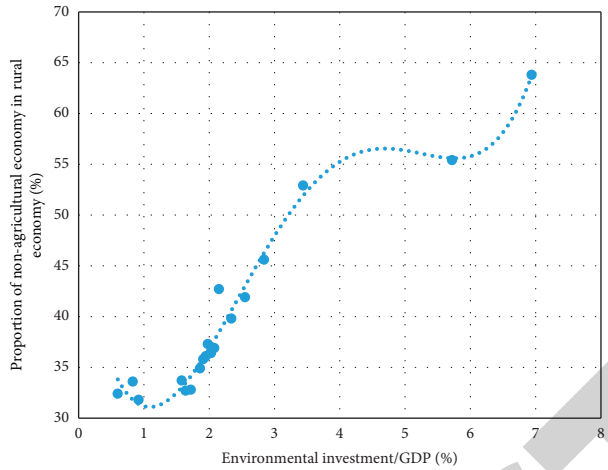

Figure 5: Proportion of environmental investment and NAP economy.

Table 2: Correlation analysis between nonagricultural population and nonagricultural population economy.

Relevance	Coefficient of determination		Spearman	
	R^2	P	ρ	P
Proportion of nonagricultural population	0.925	0.003	0.927	0.004
Economic proportion of nonagricultural population	0.903	0.005	0.906	0.007

6. Summary

With the in-depth development of the implementation of the RRS, the rural industrial economy has made a qualitative leap. The RRT strategy not only integrates and optimizes different rural industries but also comprehensively adjusts the unbalanced situation of regional economic development of various industries. In view of the analysis of the current situation of rural economic development and ecological environment, this study focuses on national policy guidance, social investigation, industrial structure adjustment, and relevant capital investment. Finally, it is considered that the investment of rural ecological environment capital is not only positively related to the RRT but also positively related to the development of URI. The degree of integration and fit between them are very high, it can effectively promote the development of rural industrial economy, narrow the economic gap between urban and rural areas, and promote closer interaction between urban and rural areas, taking the coordinated promotion of the rural revitalization strategy and the new urbanization strategy as the main body, accelerating the formation of a new type of urban-rural relationship that integrates urban and rural areas in an all-round way and makes them prosperous together, and promoting the integrated development of the new type of urbanization into urban and rural areas, so as to promote the overall coordinated development of rural economy [13].

Data Availability

The data underlying the results presented in the study are available within the manuscript.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

Authors' Contributions

All authors have seen the manuscript and approved to submit the journal.

References

[1] E. Hou, "The Key Tasks of New Urbanization and Integrated Urban-Rural Development in 2021 urges the green and low-carbon transformation and development of the construction industry[J]," *Building Energy Saving (Chinese and English)*, vol. 49, no. 04, p. 44, 2021.

[2] X. Lu, "Interpretation of the national rural revitalization strategic plan (2018-2022)——we will develop and expand rural industries[J]," *Rural practical technology*, vol. 2021, no. 08, pp. 29-30, 2021.

[3] J. Zhao, "Analysis on the development path of urban-rural integration under the background of new urbanization and rural revitalization[J]," *Rural economy and science and technology*, vol. 32, no. 14, pp. 247–249, 2021.

[4] J. Chen and D. Zhang, "Coupled and coordination in urban-rural integration: new urbanization and rural revitalization[J/OL]," *China's Agricultural Resources and regionalization*, vol. 1-13, 2022.

[5] W. Ma, "Research on the practical path of rural revitalization and new urbanization coordination[J]," *The northern economy*, vol. 2022, no. 01, pp. 65–68, 2022.

[6] M. Zhao, "The coupled coordination of new urbanization and rural revitalization under the background of urban-rural

Hindawi
Journal of Environmental and Public Health
Volume 2023, Article ID 9857139, 1 page
https://doi.org/10.1155/2023/9857139

Retraction

Retracted: Measuring the Awareness of Chronic Kidney Disease (CKD) with Environmental Evaluation among Adult Diabetic Patients in Hail Region, Saudi Arabia

Journal of Environmental and Public Health

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References

[1] A. Nahlah Fahad, A. Ahmed Alkhateeb, A. Rabah Alsharari, A. Naif Alharbi, and A. Abdullaziz Hamed, "Measuring the Awareness of Chronic Kidney Disease (CKD) with Environmental Evaluation among Adult Diabetic Patients in Hail Region, Saudi Arabia," *Journal of Environmental and Public Health*, vol. 2022, Article ID 4505345, 6 pages, 2022.

Hindawi
Journal of Environmental and Public Health
Volume 2022, Article ID 4505345, 6 pages
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Research Article

Measuring the Awareness of Chronic Kidney Disease (CKD) with Environmental Evaluation among Adult Diabetic Patients in Hail Region, Saudi Arabia

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Received 26 May 2022; Revised 8 June 2022; Accepted 15 June 2022; Published 29 June 2022

Academic Editor: Sivakumar Pandian

Introduction. Chronic kidney disease (CKD) is one of the main chronic complications of T2DM that happens among T2DM patients who have uncontrolled glucose. Because CKD is considered a silent disease, the diagnosis is usually made at late stages when there will be few chances to prevent the adverse outcome. *Aim*. The goal of this study was to assess adult diabetic patients' awareness of developing chronic kidney disease at the community level in Hail region, Saudi Arabia, in 2022. *Patients and Methods*. This is a cross-sectional study conducted among diabetic patients in the Hail region, Saudi Arabia. A self-administered questionnaire translated into Arabic was distributed among patients with DM. The questionnaire covers social and demographic variables (such as age, gender, relationship status, and so on) as well as a 7-item questionnaire to assess the DM population's knowledge of CKD. *Results*. 400 DM patients responded to our survey (51% females vs 49% males). Patients who were diagnosed with type 2 diabetes were 23.8% and 40.5% had a diabetes duration of 5–15 years. Nearly half (46.8%) were considered as a poor level of awareness, 29.3% had a moderate, and 24% had a good awareness level. Factors associated with an increased level of awareness were being a bachelor's degree, being unmarried, being a student, and having a doctor as a source of CKD information. *Conclusion*. There was a deficiency in the level of awareness among the diabetic patients in our region. Patients who were single with better education and who were well informed by the doctors about CKD information tend to be more aware of CKD as compared to other DM patients. Further research is warranted in order to establish the awareness level of DM patients regarding CKD and its complications.

1. Introduction

Diabetes mellitus (DM) is a collection of metabolic abnormalities defined by elevated blood glucose levels caused by a deficiency in circulating insulin, insulin resistance, or overproduction of hormones that inhibit insulin function [1]. From an epidemiological point, diabetes mellitus is one of the most common causes of death, disability, and economic loss worldwide. WHO predicted that by 2030, 366 million people will establish DM [2, 3]. Diabetes is classified into three types: type 1 (T1DM), type 2 (T2DM), and gestational diabetes. Type 1 DM mainly occurs secondary to an autoimmune destruction of beta cells in the islets of Langerhans in the pancreas, leading to a reduction in insulin secretion. T2DM occurs due to a defect in the action of insulin because of insulin resistance by body tissues [4]. Chronic complications are considered major consequences of T2DM which will impact the quality of life of patients. Chronic kidney disease (CKD) is one of the most common chronic consequences of T2DM in adults with uncontrolled

glucose levels. [5] Diabetes is considered the leading cause of chronic kidney disease, 44% of CKD patients suffered from DM. Up to 77% of DM patients missed diagnosis with CKD. T2DM patients who have CKD are at risk for coronary artery disease as well [6, 7]. Because CKD is considered a silent disease, the diagnosis usually made at late stages, when there will be few chances to prevent the adverse outcome [8]. Loss of opportunities for prevention with insufficient care will lead to disease progression [9–14]. Because of lacking in the data that shows the awareness level regarding CKD among adult diabetic patients in the Hail region, Saudi Arabia, our aim in this study is to determine awareness and encourage it.

2. Methods

This is a cross-sectional research conducted during 11 April to 18 May, 2022, among diabetic patients in the Hail region, Saudi Arabia. A self-administered questionnaire translated into Arabic was distributed among patients with DM. The Ethical Committee of the University of Hail's College of Medicine gave their approval prior to the start of the study initiation (approved number H-2022-190). With a 95 percent confidence interval and a five percent margin of error, the Raosoft sample size calculator calculated a sample size of 402 from the total population of the Hail city which is estimated at 731,000. The questionnaire includes demographic characteristics (i.e. age, gender, marital status, etc.) as well as a 7-item questionnaire to measure the awareness of the DM population regarding CKD. The survey was shared via various social platforms. A p value less than 0.05 is considered significant. To present the findings, tables and graphs are used. The study's contribution is to determine the level of awareness of the chronic renal disease among diabetes patients at the community level in the Hail region, Saudi Arabia, in 2022.

3. Statistical Analysis

The calculation of the awareness total score was drawn from 7-item questionnaires with "yes" coded as 1 and "no/I do not know" coded as 0 were the answer options. The overall score has been obtained by combining all 7 items. A possible score range from 0 to 7 has been generated, which indicates that the higher the score the higher the awareness of CKD. By using 50% and 75% as cutoff points to determine the level of awareness, participants were organized as having poor awareness if the score was from 0 to 3 points, 4 to 5 were considered moderate awareness, and 6 to 7 were considered as good awareness level.

Measures of central tendency and dispersion were used to analyze the continuous (numerical) variables. All the categorical (nominal) data were presented as numbers and percentages. The comparison between the score of awareness and the demographic characteristics of the patients had been conducted using the Mann–Whitney Z-test as well as the Kruskal–Wallis H-test. Two-tailed analysis with $p < 0.05$ was used as a cutoff for statistical significance. The normality test was performed using the Shapiro–Wilk test. All data analyses were performed using the Statistical Package for Social Sciences, version 26 (SPSS, Armonk, NY : IBM Corp, USA).

Table 1: Demographic characteristics of the diabetic patients ($n = 400$).

Study data	N (%)
Age group	
18–20 years	54 (13.5%)
21–30 years	135 (33.8%)
31–40 years	63 (15.8%)
>40 years	148 (37.0%)
Gender	
Male	196 (49.0%)
Female	204 (51.0%)
Educational level	
Illiterate	23 (05.8%)
Primary school	14 (03.5%)
Elementary school	31 (07.8%)
High school	97 (24.3%)
Bachelor degree	235 (58.8%)
Marital status	
Single	170 (42.5%)
Married	209 (52.3%)
Divorced	21 (05.3%)
Occupation	
Student	125 (31.3%)
Employed	152 (38.0%)
Unemployed	123 (30.8%)
Type of diabetes	
Type 1	70 (17.5%)
Type 2	95 (23.8%)
I do not know	235 (58.8%)
Duration of diabetes	
<5 years	137 (34.3%)
5–15 years	162 (40.5%)
>15 years	101 (25.3%)

4. Results

A total of 400 diabetic patients were recruited. As described in Table 1, the commonest age group was more than 40 years old (37%) with more than half (51%) being females. With regards to education, nearly 60% were bachelor's degrees. Married patients constitute 52.3% and 38% were employed. Patients with type 2 diabetes were reported by 23.8% and 40.5% had a DM duration of 5–15 years.

Figure 1 depicted patients' sources of CKD information. It can be observed that the most common source of information was the doctor (44.5%), followed by the Internet (22.5%), and friends and relatives (20.3%).

Table 2 shows the assessment of awareness of CKD among diabetic patients. Following the results, it can be shown that 63.7% of the patients knew that diabetes is a major cause of CKD, and 48.8% believed that all diabetics should have a periodic kidney function analysis. The proportion of the patients who believed that there are effective ways to avoid CKD was 54.8% while the proportion of patients who knew the symptoms associated with CKD was 45% and those who were aware of the complication of CKD

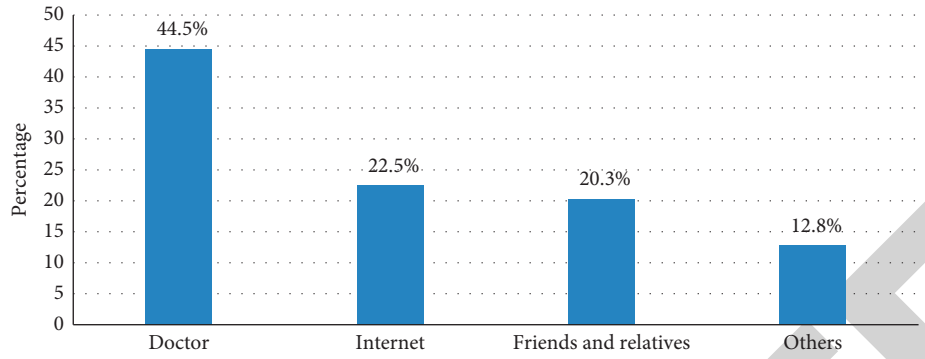

Figure 1: Sources of CKD information.

Table 2: Assessment of awareness of chronic kidney disease (CKD) among diabetic patients ($n = 400$).

Awareness statement	Yes (%)
1. Did you know that diabetes is a major cause of chronic kidney disease?	255 (63.7%)
2. Do you think that all diabetics should do a periodic kidney function analysis even if they were asymptomatic?	195 (48.8%)
3. Do you believe that there are efficient ways to avoid chronic kidney disease?	219 (54.8%)
4. Are you aware of any of the symptoms associated with chronic kidney disease?	180 (45.0%)
5. Are you aware of the complications of chronic kidney disease?	174 (43.5%)
6. Early screening and treatment of chronic kidney disease can reduce the risk of kidney failure?	251 (62.7%)
7. Have you ever done a kidney function test?	212 (53.0%)
Total awareness score (mean ± SD)	3.71 ± 2.14

was 43.5%. Patients who believed that early screening and treatment of CKD can reduce the risk of kidney failure were 62.7%. Finally, 53.% of the patients underwent a kidney function test. The overall awareness score was 3.71 (SD 2.14).

In Figure 2, the level of knowledge toward CKD among diabetic patients was poor, moderate, and good among 46.8%, 29.2%, and 24%, respectively.

When measuring the association between the awareness score and the sociodemographic characteristics of the patients, it was observed that a higher awareness score was more associated with being a bachelor's degree ($Z = 3.201$; $p = 0.001$), being unmarried ($Z = 2.883$; $p = 0.004$), being a student ($H = 22.651$; $p < 0.001$), and having a doctor as a source of CKD information ($H = 62.208$; $p < 0.001$). Other variables showed no significant association with awareness score including age group, gender, type of diabetes, and duration of diabetes ($p > 0.05$) (see Table 3).

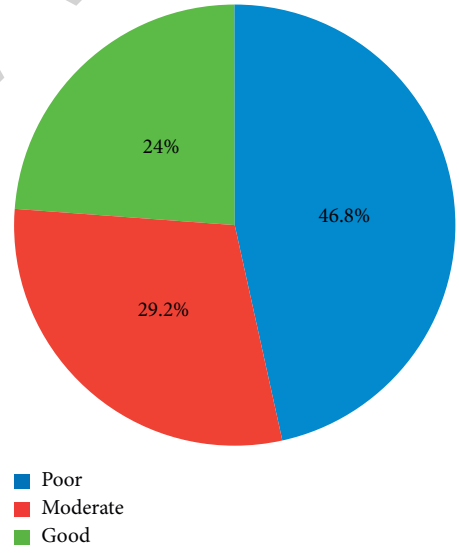

Figure 2: Level of awareness toward CKD.

5. Discussion

The goal of this study was to determine the level of awareness of the chronic renal disease among diabetes patients. Our results showed that the awareness level of the patients regarding CKD was low. 46.8% of the patients appeared to have poor awareness levels, 29.2% were moderate and only 24% were shown to have a good understanding of the disease. Several studies established a low level of awareness in patients and their caregivers [1, 7, 15–20]. However, in Palestine [19], hypertensive individuals scored higher on total knowledge and attitude toward chronic renal disease prevention and early detection. The study further highlights the importance of having good knowledge, as well as a good attitude toward CKD, as improving both dimensions, had a relatively good chance of preventing CKD and its progression.

Education came out as a significant factor of awareness, where patients with bachelor's degrees exhibited better awareness levels than patients who are less educated. This is consistent with the report of Sa'adeh et al. [19], as well as Ahmed et al. [21], who reported that greater knowledge levels were significantly predicted among patients with higher educational levels. However, this has been contradicted by the report of Plantinga et al. [20]. After controlling

Table 3: Association between the awareness and the sociodemographic characteristics of the diabetic patients ($n = 400$).

Factor	Awareness Score (7) Mean ± SD	Z/H-test	p value
Age group[a]			
≤30 years	3.93 ± 2.18	$Z = 1.804$	0.071
>30 years	3.53 ± 2.10		
Gender[a]			
Male	3.88 ± 2.10	$Z = 1.534$	0.125
Female	3.55 ± 2.18		
Educational level[a]			
High school or below	3.32 ± 2.10	$Z = 3.201$	0.001**
Bachelor degree	3.99 ± 2.13		
Marital status[a]			
Unmarried	4.05 ± 2.06	$Z = 2.883$	0.004 **
Married	3.41 ± 2.18		
Occupation[b]			
Student	4.34 ± 2.07		
Employed	3.75 ± 2.17	$H = 22.651$	<0.001**
Unemployed	3.03 ± 1.99		
Type of diabetes *[a]			
Type 1	3.93 ± 1.93	$Z = 1.084$	0.279
Type 2	3.62 ± 2.21		
Duration of diabetes[b]			
<5 years	3.36 ± 2.11		
5–15 years	3.83 ± 2.02	$H = 5.951$	0.051
>15 years	4.01 ± 2.33		
Source of CKD information[b]			
Doctor	4.62 ± 2.05		
Friends and relatives	2.69 ± 1.81	$H = 62.208$	<0.001**
Internet	3.44 ± 1.96		
Others	2.67 ± 1.96		

*Patients who did not know their diabetes type were excluded from the analysis. [a]p value has been analyzed using the Mann–Whitney Z-test. [b]p value has been analyzed using the Kruskal–Wallis H-test. **Significant at $p < 0.05$level.

for other variables, they discovered that wealth and educational levels had no effect on awareness of the personal risk of CKD status. They also stated that additional social factors such as marital status, social support, and having friends or acquaintances with CKD have yet to be investigated more in relation to CKD awareness. However, in our study, we managed to find a significant association between marital status and the level of awareness of patients about CKD, suggesting that unmarried patients tend to be more aware of CKD than married patients. More investigations are required in order to establish the true effect of social status on the CKD awareness level. Additionally, we noted that being a student likely to demonstrate a better understanding of the disease compared to other DM patients which may also need further investigations.

In Palestine [19], a study found that patients who were less than 65 years were associated with higher knowledge scores of the disease. However, a study published in the USA [20], saw age as unrelated to the awareness level but they hypothesized that men with CKD would be more aware of their disease condition than women. In our study, both gender and age did not differ significantly with the level of awareness which did not coincide with previous results.

Our patients usually obtained CKD information from the doctor (44.5%), and it showed significant relation with awareness. Other sources of CKD information were the Internet (22.5%) and friends and relatives (20.3%). The source of information is one of the best ways to improve awareness. Our patients were shown to have the best source of the disease which is the 'doctor.' In Jeddah, Saudi Arabia [22, 23], respondents preferred campaigns as a way to increase their awareness (59%) followed by media (48.5%). They further added that high-income participants were more likely to select clinics, campaigns, and the media as the best sources of CKD information.

The lack of awareness of CKD in our patients stemmed from the specific assessment of their understanding of the disease. For instance, poor awareness was shown about the complication of CKD (43.5%), as well as symptoms associated with CKD (45%). More than half of them (51.2%) were against the opinion that all diabetic patients should undergo a regular kidney function test even if asymptomatic. On the other hand, a handful of patients were knowledgeable that DM is a major cause of CKD (63.7%) and were aware that early screening and treatment can reduce the risk of kidney failure (62.7%). Conversely, patients were shown modest knowledge about the effective ways to avoid CKD (54.8%) and undergoing kidney function tests (53%). Consistent with our findings, a study conducted in Al Ahsa governorate showed that 52.8% of participants were aware that diabetes can lead to CKD, only 26.9% were unaware of the link between CKD and uncontrolled DM, and only

20.4% had never heard of CKD. However, a deficiency in the knowledge about the effective ways to prevent CKD (50%), the worst complication of CKD (29.3%), and the knowledge to notice the symptoms of CKD (14.5%) were shown in patients with diabetes [16, 24]. It is widely agreed that public awareness initiatives are required to enhance public awareness of CKD, its progression, and its complications.

6. Conclusion

Diabetic patients in our region are lacking awareness. Patients who were single with better education and who were well informed by the doctors about CKD information tend to be more aware of CKD as compared to other DM patients. The awareness levels among DM patients must be improved to prevent CKD, its development, and its complications. More efforts are needed to address the lack of awareness among diabetic patients. This can be done through awareness dissemination of CKD basic information. Further research is warranted in order to establish the awareness level of DM patients regarding CKD and its complications.

Data Availability

The data used to support the findings of this study are included within the article.

Consent

Informed consent was obtained from all subjects involved in the study.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

Acknowledgments

The authors would like to thank the University of Hail for providing them with the tool to conduct this research.

References

[1] B. A. Farran, R. I. Elaiwah, A. T. Aldarsouny et al., "Level of awareness of diabetic ketoacidosis among diabetes mellitus patients in Riyadh," *Journal of Family Medicine and Primary Care*, vol. 9, no. 6, pp. 2676–2679, 2020.

[2] M. B. Alazzam, N. Tayyib, S. Z. Alshawwa, and M. Ahmed, "Nursing care systematization with case-based reasoning and artificial intelligence," *Journal of Healthcare Engineering*, vol. 2022, Article ID 1959371, 2022.

[3] WHO, *Prevention of Blindness from Diabetes Mellitus*, World Health Organization, Geneva, Switzerland, 2005.

[4] F. K. Alanazi, J. S. Alotaibi, P. Paliadelis, N. Alqarawi, A. Alsharari, and B. Albagawi, "Knowledge and awareness of diabetes mellitus and its risk factors in Saudi Arabia," *Saudi Medical Journal*, vol. 39, no. 10, pp. 981–989, 2018.

[5] Z. Liu, C. Fu, W. Wang, and B. Xu, "Prevalence of chronic complications of type 2 diabetes mellitus in outpatients—a cross-sectional hospital based survey in Urban China," *Health and Quality of Life Outcomes*, vol. 8, no. 1, 2010.

[6] M. B. Alazzam, A. T. Al-Radaideh, N. Binsaif, A. S. AlGhamdi, and M. A. Rahman, "Advanced deep learning human herpes virus 6 (HHV-6) molecular detection in understanding human infertility," *Computational Intelligence and Neuroscience*, vol. 2022, Article ID 1422963, 2022.

[7] T. Fiseha and Z. Tamir, "Prevalence and awareness of chronic kidney disease among adult diabetic outpatients in northeast Ethiopia," *BMC Nephrology*, vol. 21, no. 1, 2020.

[8] L. A. Szczech, R. C. Stewart, H.-L. Su et al., "Primary care detection of chronic kidney disease in adults with type-2 diabetes: The add-CKD study (awareness, detection and drug therapy in type 2 diabetes and chronic kidney disease)," *PLoS One*, vol. 9, no. 11, Article ID e110535, 2014.

[9] A. Abdullah Hamad, M. L. Thivagar, M. Bader Alazzam, F. Alassery, F. Hajjej, and A. A. Shihab, "Applying dynamic systems to social media by using controlling stability," *Computational Intelligence and Neuroscience*, vol. 2022, Article ID 4569879, 2022.

[10] Kdoqi, "Kdoqi clinical practice guidelines and clinical practice recommendations for diabetes and chronic kidney disease," *American Journal of Kidney Diseases*, vol. 49, no. 2, 2007.

[11] M. B. Alazzam, H. Mansour, F. Alassery, and A. Almulihi, "Machine learning implementation of a diabetic patient monitoring system using interactive E-app," *Computational Intelligence and Neuroscience*, vol. 2021, Article ID 5759184, 2021.

[12] M. E. Molitch, R. A. DeFronzo, M. J. Franz, W. F. Keane, C. E. Mogensen, and H. H. Parving, "Diabetic nephropathy," *Diabetes Care*, vol. 26, pp. s94–s98, 2004.

[13] A Aldukhayel, "Prevalence of diabetic nephropathy among type 2 diabetic patients in some of the Arab countries," *International journal of health sciences*, vol. 11, no. 1, pp. 1–4, 2017 Jan-Mar.

[14] S. John, "Complication in diabetic nephropathy," *Diabetes & Metabolic Syndrome*, vol. 10, pp. 247–249, 2016.

[15] K. Kumela Goro, A. Desalegn Wolide, F. Kerga Dibaba et al., "Patient awareness, prevalence, and risk factors of chronic kidney disease among diabetes mellitus and hypertensive patients at jimma university medical center, Ethiopia," *BioMed Research International*, vol. 2019, pp. 1–8, Article ID 2383508, 2019.

[16] D. S. Albujays, H. S. barbary, and A. K. Althafar, "Study of the level of awareness of chronic kidney diseases among diabetic patients in al-ahsa governorate, kingdom of Saudi Arabia cross-sectional study," *International Journal of Scientific Study*, vol. 5, 2018.

[17] G Sahu, S Kumar, S Acharya et al., "The act of prevention: knowledge, attitudes, and perception among caretakers of kidney disease patients in rural Wardha district of central India," *Cureus*, vol. 14, no. 3, Article ID e23058, 2022 Mar 11.

[18] M. B. Alazzam, A. T. Al-Radaideh, R. A. Alhamarnah, F. Alassery, F. Hajjej, and A. Halasa, "A survey research on the willingness of gynecologists to employ mobile health applications," *Computational Intelligence and Neuroscience*, vol. 2021, Article ID 1220374, 2021.

[19] H. H. Sa'adeh, R. N. Darwazeh, A. A. Khalil, and S. E. Zyoud, "Knowledge, attitudes and practices of hypertensive patients towards prevention and early detection of chronic kidney disease: a cross sectional study from Palestine," *Clinical hypertension*, vol. 24, no. 1, pp. 1–3, 2018.

[20] L. C. Plantinga, D. S. Tuot, and N. R. Powe, "Awareness of chronic kidney disease among patients and providers," *Advances in chronic kidney disease*, vol. 17, no. 3, pp. 225–236, 2010.

Hindawi
Journal of Environmental and Public Health
Volume 2023, Article ID 9898704, 1 page
https://doi.org/10.1155/2023/9898704

Retraction

Retracted: Cognitive Analysis of Pragmatic Functions of Discourse Markers in Spoken English in the Context of Computational Intelligence

Journal of Environmental and Public Health

Received 27 June 2023; Accepted 27 June 2023; Published 28 June 2023

This article has been retracted by Hindawi following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of one or more of the following indicators of systematic manipulation of the publication process:

(1) Discrepancies in scope
(2) Discrepancies in the description of the research reported
(3) Discrepancies between the availability of data and the research described
(4) Inappropriate citations
(5) Incoherent, meaningless and/or irrelevant content included in the article
(6) Peer-review manipulation

The presence of these indicators undermines our confidence in the integrity of the article's content and we cannot, therefore, vouch for its reliability. Please note that this notice is intended solely to alert readers that the content of this article is unreliable. We have not investigated whether the authors were aware of or involved in the systematic manipulation of the publication process.

Wiley and Hindawi regrets that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our own Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

References

[1] L. Huang and Y. Zhu, "Cognitive Analysis of Pragmatic Functions of Discourse Markers in Spoken English in the Context of Computational Intelligence," *Journal of Environmental and Public Health*, vol. 2022, Article ID 9883324, 6 pages, 2022.

Hindawi
Journal of Environmental and Public Health
Volume 2022, Article ID 9883324, 6 pages
https://doi.org/10.1155/2022/9883324

Research Article

Cognitive Analysis of Pragmatic Functions of Discourse Markers in Spoken English in the Context of Computational Intelligence

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Received 20 April 2022; Revised 25 May 2022; Accepted 9 June 2022; Published 25 June 2022

Academic Editor: Sivakumar Pandian

To improve the level of oral English teaching, improve students' oral communicative competence (OCA), and promote successful communication with native English speakers, this study studies the pragmatic function of dialogue markers and constructs the cognitive evaluation system of artificial intelligence (AI) by comparing the two cognitive evaluation systems of human subjectivity and knowledge base; in this study, the credibility of human subjective evaluation and the coupling degree of machine objective evaluation are discussed. The key coefficient R^2 is obtained by the linear regression method, and the correlation is obtained by the Spearman correlation algorithm. The cognitive effects of knowledge base and AI are verified; the results show that the cognitive analysis system of pragmatic function of discourse markers in oral English based on AI has good teaching value. In the context of AI computing, we can put forward targeted learning methods and learning methods for students according to the amount and accuracy of markers in oral English that students have mastered, so that students can quickly improve the learning quality and the learning effect of oral English markers, which is more conducive to improving students' oral English level and realizing students' effective communication.

1. Introduction

The primary function of discourse markers in spoken English is to communicate. Second, discourse markers can be used as an indispensable part of organizational language, to construct the context needed for interpersonal communication. The discourse meaning to be discussed is more coherent, vivid, and organized.

In terms of pragmatic functions of spoken English discourse markers, because the types and specific forms of expression of discourse markers are relatively single and not diversified, and the pragmatic functions produced in different contexts are also different, there will be factors affecting credibility in the process of human evaluation. Wang Lu et al. in the corpus-based study on the expression patterns of cognitive positions in spoken Chinese academic English, markedness is a linguistic means for communicators to express their positions on the proposition with the help of lexical means, and it is an important resource for discourse construction [1]. In communication, the speaker can use markers to attract the listener's attention, make the discourse go on normally, and coordinate the relationship between the speaker and the listener. Zhao Yan in the study of spoken English discourse markers is conducive to the communication between discourse markers and peers and constantly expands and extends the use direction and scope of discourse markers, to help improve students' oral English expression ability [2]. In short, spoken English discourse markers can show the speaker's emotion and attitude at that time. Qu Shifei put forward suggestions for English learners, especially those who regularly participate in international academic conferences, in the study of the default semantics of the discourse marker you know in oral English, pointing out the direction for more fluent English academic communication activities [3].

In theoretical teaching and practical communication, students will be too rigid, mechanical, and inflexible in the use of discourse markers. It is also found that the use of

discourse markers varies from person to person. Some students hardly use them, while others use them too frequently and use them indiscriminately. Chen Xinren et al. expended a lot of energy to study the use of discourse markers indicating causality by English learners [4]. Due to the influence of long-term examination-oriented education, Chinese students generally have strong written examination ability, but their oral expression and communication ability is very weak, commonly known as "dumb English." Therefore, it is very urgent and necessary to improve Chinese students' oral English expression ability. Liu Xian mentioned in the study that we should supplement and develop our oral English teaching level and analyze it to provide methods and references for improving the comprehensive level of oral English teaching [5]. Relevant studies have shown that the use of discourse markers can improve the oral coherence of Chinese English learners and maintain the relevance of the content. With the development of information science and technology, modern educational and teaching technologies and tools are widely used in English teaching. Liu Jun discussed the problems and suggestions faced by oral English man-machine dialogue teaching under the background of AI. Taking the practice of oral English teaching in Yinchuan as an example, he puts forward some suggestions on the application of AI in the process of oral English teaching [6]. In a word, AI plays a very important and key role in the field of English teaching. Hou Jing proposed the deep integration of AI technology and oral English teaching in the reform of oral English teaching mode in the AI era, which enriched oral English learning resources, innovated teaching methods, and expanded the learning environment on the basis, thus improving the teaching effect [7]. Zhang Xuehua et al. analyzed the problems of Chinese students using discourse markers in oral communication. Discourse markers are a natural language phenomenon of native English speakers, which is familiar but difficult to grasp for Chinese learners. The multiple pragmatic functions of discourse markers guide students' oral English learning, cultivate students' pragmatic ability of discourse markers, improve students' oral English communication level, and cultivate knowledge-based skilled high-quality talents [8]. The application of artificial intelligence technology in oral English teaching optimizes the teaching methods and highlights the dominant position of students. By actively creating teaching situations, oral markers have developed from diversification to digitization, transforming traditional teaching into intelligent man-machine cooperative teaching, making oral personalization and autonomy, and further improving learners' comprehensive oral ability.

2. Cognitive Status of Pragmatic Functions of Discourse Markers in Spoken English

2.1. Cognitive Evaluation System Based on Human Subjective Evaluation. Artificial subjective evaluation can clearly reflect objective problems, promote or hinder the development of objective things, and evaluate different subjective thoughts and personal emotions. The evaluation conclusion is still their own subjective thoughts, and people's cognitive conclusions are often related to their own cognitive characteristics, and the so-called benevolent people see benevolence, wise people see wisdom is this truth. Based on the human subjective cognitive evaluation, everyone's judgment of the nature and degree of things from their own perspective will directly affect personal coping activities and psychosomatic reactions. Therefore, it is necessary to change the relevant process of evaluation of cognition to a certain extent and carry out human subjective cognition evaluation more objectively.

2.2. Cognitive Evaluation System Based on Knowledge Base. The knowledge base is the product of the combination of traditional database technology and artificial intelligence technology. It is a continuous collection of declarative knowledge and process knowledge in a specific field. The knowledge base contains different abstractions or specific knowledge in a specific field. It is a clear description of the conceptualization of its knowledge base at the level of knowledge ontology. The knowledge base also pays more attention to the expression of terms and the relationship between terms at the conceptual level. At present, the general mode of knowledge base system is the three-level knowledge system of "fact + concept + rule," and the three-level knowledge representation system is also developed on the basis of knowledge ontology. At present, the cognition of knowledge base is an important branch of AI technology system, one of the key contents of China's national strategy for the development of AI and the key core technology for the transformation of various industries in traditional entity industries. However, in the process of transformation of relevant knowledge collection, due to many historical and other influencing factors, the development of traditional knowledge collection is difficult to meet the different needs of the current intelligent era, which also seriously hinders the process of intelligent transformation of the education industry. The cognitive evaluation analysis of the original knowledge base is shown in Figure 1.

Figure 1 shows the cognitive evaluation process of the application of traditional knowledge base in oral English teaching. Based on the cognition of the original text, it is divided into two parts: positive semantic base and negative semantic base. The corresponding positive score data and negative score data of semantic base are obtained from the semantic base, and the comprehensive score of the evaluation is obtained after the score data are comprehensively weighted and calculated by the experts.

2.3. AI-Based Cognitive Evaluation System. AI is the extension of the human brain. It not only has the same level of intelligence as human beings but also has the ability to learn, calculate, and judge alone. In the practical application of AI technology, it can replace human beings to complete most of the work in life. In the cognitive evaluations of AI, the cognitive intention, cognitive degree, and cognitive channel of different pragmatic functions in the teaching process within the scope of the evaluation system will be

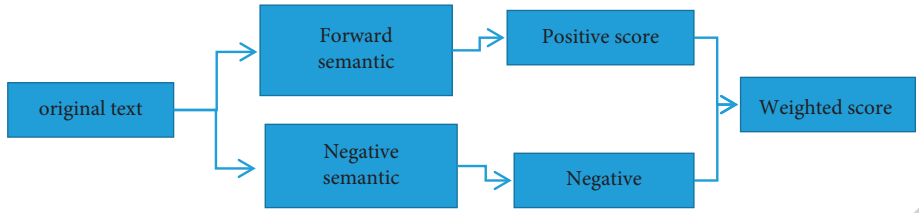

Figure 1: Analysis of cognitive evaluation system of knowledge base.

comprehensively evaluated and scored, and the most scientific, reasonable, and fair evaluation data results will be calculated by AI (Figure 2).

After the fuzzy evaluation of the original data is performed in the second round of cognitive data fusion, the results of the second round of fuzzy evaluation of the cognitive function are expanded in the second round of cognitive data fusion.

3. Cognitive Problems of Pragmatic Functions of Discourse Markers in Oral English

3.1. Credibility of Subjective Evaluation. Artificial subjective evaluation is one of the basic viewpoints reflecting different cognitions in daily life. Artificial subjective evaluation and things cannot be measured, but can be "evaluated." Subjective evaluation is scored and evaluated from the perspective of individuals, sometimes with personal emotional color, and sometimes one-sided and arbitrary. Therefore, the credibility of the final evaluation is not enough. In this case, we should consider the difference in credibility brought by human subjective evaluation. For the pragmatic function of spoken English discourse markers, because the types and specific forms of expression of discourse markers are relatively single, not diversified, and the linguistic functions produced in different contexts are also different, many factors affecting credibility will appear in the process of human evaluation. In the actual teaching process, it will affect the students' lack of enthusiasm for the classroom, make the students lack interest in oral English learning, reduce the students' enthusiasm, and attack the students' self-confidence, so that the artificial subjectivity will affect the objectivity and fairness of the teaching evaluation system.

3.2. Coupling Degree of Machine Objective Evaluation. In spoken English, the frequency, quantity, and type of discourse markers or the needs of more complex pragmatic functions of dialogue markers are diverse. It is necessary to consider that discourse markers will produce different pragmatic functional effects in different contexts, which will also lead to different coupling degrees of pragmatic functional evaluation in oral practice. In this case, it is also necessary to strengthen the correct and rational use of discourse markers in the process of oral English. In the traditional English teaching, the teaching method is single, the students' mastery and understanding of classroom knowledge are not comprehensive, and there is a lack of targeted teaching, which makes the students lack interest in oral English learning. In the application of oral English, they cannot correct the mistakes in time, which reduces the students' enthusiasm and hits the students' self-confidence. The application of AI technology in oral English can fully integrate and apply computational intelligence technology to oral English teaching and provide intelligent, personalized, and multi-style teaching methods in the teaching process, and students can experience and interact in the learning process according to their hobbies and needs. Therefore, when using machines to objectively evaluate different pragmatic functions in spoken English, we will more scientifically consider the evaluation data coupling analysis of relevant pragmatic functions in actual teaching. Intelligent machines can objectively and fairly score the information and data coupling evaluation results under different teaching methods, which is more conducive to the coupling development of education system evaluation in the future.

4. Verification of the Cognitive Effect Based on Two Recognition Functions

4.1. Data Sources. The simulation data of the above algorithm is from the actual operation data of MATLAB software; the subjective data come from the subjective evaluation result data in the real person evaluation experiment.

4.2. Statistical Methods. In the cognitive evaluation of knowledge base under the background of human subjective evaluation and intelligence, it is necessary to use a variety of different basis function calculation formulas for the relevant data in the evaluation system, to better analyze the results of the two evaluation systems. First, the calculation formula of the fuzzy neural network is used to control the sixth-order polynomial depth iterative regression basis function of the recent change law of time-series data of the evaluation system, as shown as follows:

$$y = \sum_{i=1}^{n} \sum_{j=0}^{5} A_j x_i^j, \tag{1}$$

where A_j coefficients are regressed of the j order polynomial, that is, each node in the function formula contains A_0–A_5 coefficients to be regressed; j is the polynomial order of the basis function.

The second is the logarithm depth iterative regression function of the fuzzy neural network for statistical analysis of

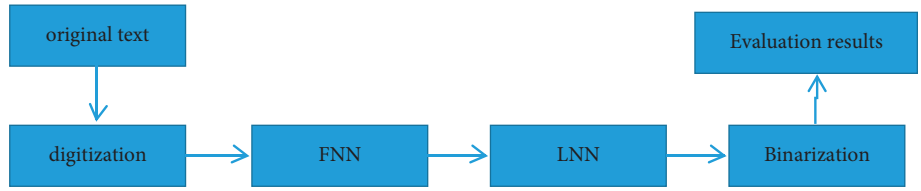

Figure 2: Analysis of the AI's cognitive evaluation system.

different information data in the evaluation, as shown as follows:

$$y = \sum_{i=1}^{n} (\mathrm{A} \cdot \log x_i + \mathrm{B}), \tag{2}$$

where A and B are the coefficients to be regressed; the meanings of other mathematical symbols are the same as those above; in the process of evaluation system data output, it is necessary to binarize the output data in turn and transform the logical data. The binary neural network algorithm is as follows:

$$y = \sum_{i=1}^{n} \frac{1}{A + B \cdot e^{x_i}}, \tag{3}$$

where e is the natural constant; other mathematical symbols have the same meaning as formula (2); in the training of binary output data, if the data falling point is within the invalid interval of evaluation data, it is considered that the neural network has not fully converged. This model can judge the convergence degree of neural network training.

When analyzing the key coefficients of cognitive evaluation data, it is necessary to apply the nonlinear curve estimation algorithm: determination coefficient R^2:

$$\begin{aligned} R^2 &= \frac{\sum_i (x_i - \overline{x})}{\sum_i (x_i - \overline{x}_i)}, \\ \overline{x} &= \frac{1}{n} \sum_{i=1}^{n} x_i, \end{aligned} \tag{4}$$

where $\overline{x}$ is the arithmetic mean of the investigated sample sequence, x_i is the i input value in the sequence, and n is the number of investigation samples.

When analyzing the correlation of information data, we need to use the Spearman correlation algorithm:

$$\rho_s = \frac{\sum_{i=1}^{N} (R_i - \overline{R})(S_i - \overline{S})}{\left[\sum_{i=1}^{N} (R_i - \overline{R})^2 \sum_{i=1}^{N} (S_I - \overline{S})^2\right]^{1/2}}, \tag{5}$$

where R_i and S_i are the grades of the observed values, respectively; $\overline{R}$ and $\overline{S}$ are the average grades of variables x and y, respectively.

4.3. Result Analysis of Evaluation Coupling Degree. In the different cognitive evaluations of the pragmatic function of discourse markers in oral English, it is necessary to analyze the factors affecting the coupling and coordination of the two evaluation systems in the process of cognitive evaluation based on the practical data indicators of oral English application, to analyze the coupling results of different evaluation cognition. The comparative analysis of the coupling degree of two different cognitive evaluation systems is given in Table 1.

To observe and compare the coupling degree data of two different cognitive evaluation systems more objectively, the data coupling results in Table 1 are visualized, as shown in Figure 3.

Table 1 and Figure 3 show the comparison results of the coupling degree of the evaluation cognitive system using the knowledge base algorithm and AI algorithm. The results clearly show that the key coefficients and correlation in the evaluation cognitive system under the application of the AI algorithm are higher than the evaluation cognitive coupling degree of the knowledge base algorithm, and the P values are less than 0.005. It is considered that the evaluation cognition system using AI technology can promote the coupling development of the evaluation system.

4.4. Result Analysis of Evaluating Credibility. Credibility is mainly analyzed and judged according to its legitimacy, authority, professionalism, standardization, transparency, and other factors. In the process of understanding the educational evaluation system, we also need to fully consider the connotation and influencing factors of credibility. For example, in the credibility evaluation index system, the analysis and comparison of key coefficients and correlation data are given in Table 2.

According to the credibility comparison data of two different cognitive evaluation systems in Table 2, Figure 4 is obtained.

Table 2 and Figure 4 show the comparison of the credibility of two different knowledge evaluation systems. The R^2 value of the key coefficient in the evaluation of the AI algorithm is significantly higher than that of the knowledge base algorithm ρ. The evaluation understanding of the AI algorithm in value comparison has also been significantly improved. Finally, the cognitive evaluation using the AI algorithm can scientifically and effectively evaluate the pragmatic function of discourse markers in oral English, improve students' oral English level, and increase students' overall self-confidence.

4.5. On the Cognitive Application of Pragmatic Function in the Process of English Teaching. With the rapid development of social education, the importance of learning English has become more prominent. At present, English has become the most widely used language in various fields. For example,

Table 1: Comparison of coupling degree of different cognitive evaluation systems.

Grouping	Key coefficient		Relevance	
	R^2	P	ρ	P
Knowledge base algorithm	0.867	0.006	0.825	0.008
AI algorithm	0.936	0.001	0.907	0.003

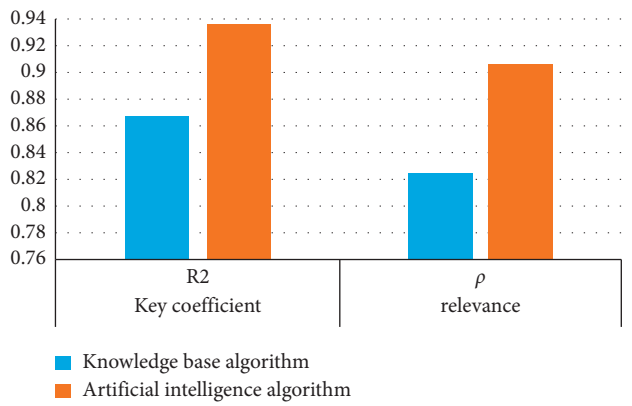

Figure 3: Visual comparison of coupling degree of different cognitive evaluation systems.

Table 2: Comparison of credibility of different cognitive evaluation systems.

Grouping	Key coefficient		Relevance	
	R^2	P	ρ	P
Knowledge base algorithm	0.812	0.008	0.839	0.007
AI algorithm	0.941	0.002	0.925	0.002

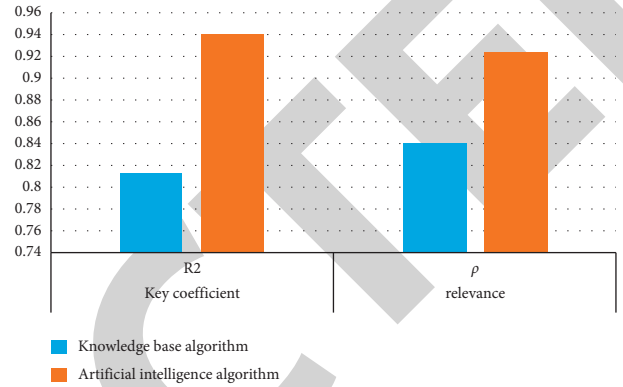

Figure 4: Visual comparison of credibility of different cognitive evaluation systems.

to increase knowledge, broaden horizons, and work abroad, the scope of application of English is becoming more and more extensive. Qiu Huixiang holds that in English teaching, teachers should pay attention to cultivating students' English application ability, especially students' oral English expression ability. Teachers strengthen the interactive teaching method applied in oral English teaching, which helps to improve students' oral expression ability. Moreover, the application of interactive teaching in oral English teaching breaks the teaching mode of "one speech hall," advocates oral English teaching, carries out role-playing activities, and pays attention to the output of teaching results, to improve students' oral English ability and level [9]. Therefore, more and more attention is paid to the shaping and comprehensive application of oral English in the teaching system. In students' oral expression, it is found that students often cannot use discourse markers correctly, because the same discourse marker will have different meanings in different contexts, so the use of oral markers in oral English can better regulate the interpersonal relationship between both sides, clarify the relationship between the front and back discourse, maintain pragmatic balance, successfully show the speaker's emotion and intention, and make the listener better understand the discourse, to achieve the purpose of harmonious communication. Regular reading enables students to more directly understand the function and grammar of oral markers in the context, enhance students' awareness of table markers, and fully practice and master the usage of table markers. Oral English conversation practice between teachers and students and between students and students in oral English teaching is advocated. Students must be encouraged to dare to speak, be able to speak, and be able to speak. Students are guided to understand the role of discourse markers in conversation, discourse markers in the process of conversation are consciously used, and oral coherence is improved.

In recent years, due to the rapid development of AI application technology in oral English teaching, AI information technology has been integrated into oral English teaching and students' learning. Creating an oral communication atmosphere through human-computer interaction can strengthen the cultivation of students' oral English and improve students' interest in learning English. Long Gaoyan proposed that introducing AI technology into primary school information technology classroom teaching will help stimulate students' interest in exploration, create more interesting teaching classes for students, and let students actively participate in the information technology teaching activities created by teachers [10]. It can be seen that improving students' interest has a great impact on learning efficiency. Through the analysis of the data in the process of students' learning, we can timely adjust the teaching strategy and optimize the teaching process. According to Hou Jing , the effective and deep integration of AI technology and oral teaching has promoted the reform of oral teaching mode, promoted the development of oral teaching towards intelligence, and achieved the purpose of effectively improving the effect of oral teaching on the basis of enriching oral learning resources, innovating teaching methods and teaching evaluation, and expanding the learning environment [7]. Lu Guoqing et al. classroom teaching behavior is an important factor affecting the effect of classroom teaching. The existing collection of classroom teaching behavior has shortcomings such as labor-intensive, fuzzy classification, and complex coding. AI technology provides a new opportunity for the accompanying collection of big data and automatic intelligent annotation of classroom teaching

Hindawi
Journal of Environmental and Public Health
Volume 2023, Article ID 9853235, 1 page
https://doi.org/10.1155/2023/9853235

Retraction

Retracted: Analysis of China's Population Flow between Urban and Rural Areas and the Reform of Public Health Old-Age Insurance System under the Background of Sustainable Ecological Environment

Journal of Environmental and Public Health

Received 15 November 2022; Accepted 15 November 2022; Published 5 February 2023

Journal of Environmental and Public Health has retracted the article titled "Analysis of China's Population Flow between Urban and Rural Areas and the Reform of Public Health Old-Age Insurance System under the Background of Sustainable Ecological Environment" [1] due to concerns that the peer review process has been compromised.

Following an investigation conducted by the Hindawi Research Integrity team [2], significant concerns were identified with the peer reviewers assigned to this article; the investigation has concluded that the peer review process was compromised. We therefore can no longer trust the peer review process, and the article is being retracted with the agreement of the Chief Editor.

References

[1] H. Guo and Q. Luo, "Analysis of China's Population Flow between Urban and Rural Areas and the Reform of Public Health Old-Age Insurance System under the Background of Sustainable Ecological Environment," *Journal of Environmental and Public Health*, vol. 2022, Article ID 9752913, 2022.

[2] L. Ferguson, "Advancing Research Integrity Collaboratively and with Vigour," 2022, https://www.hindawi.com/post/advancing-research-integrity-collaboratively-and-vigour/.

Hindawi
Journal of Environmental and Public Health
Volume 2022, Article ID 9752913, 8 pages
https://doi.org/10.1155/2022/9752913

Research Article

Analysis of China's Population Flow between Urban and Rural Areas and the Reform of Public Health Old-Age Insurance System under the Background of Sustainable Ecological Environment

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Received 6 April 2022; Revised 19 April 2022; Accepted 28 April 2022; Published 22 June 2022

Academic Editor: Sivakumar Pandian

The future impact of population development trend on social security is extremely huge and far-reaching, to conform to the law of population mobility to adjust the relevant policies, this study is for the urban and rural flow of the Chinese population, and the public health endowment insurance system analyzes the implementation status of PHEI of China's floating population and the existing problems of labor dispatch and employee endowment insurance system. Questionnaires were distributed to 3000 high-quality migrant workers who participated in the training of high-quality migrant workers in 6 cities in Central China where labor export is concentrated and 1000 fresh graduates from agricultural colleges and universities; through the bivariate *t*-check model in SPSS software, this study analyzes the needs of landless farmers, agricultural scientific and technological talents, and employed people for the living environment. The results show that from the population outflow and population inflow process there has been certain influence on the sustainable ecological environment; this study puts forward the reform of public health endowment insurance system of floating population, the strategy means in accelerating the rural talent revitalization, for the sustainable development of rural areas that has a significant positive effect.

1. Introduction

Since the 1980s, China's population flow has gradually increased. On February 23, 2021, the general office of the CPC Central Committee and the general office of the State Council issued the opinions on accelerating the revitalization of rural talents and asked all localities to study and implement them [1]. The document points out that "the key to rural revitalization lies in people." It should be made use of public service facilities such as high-quality migrant workers' skill training institutions and labor dispatch agencies established by governments at all levels to improve the knowledge and skill quality of migrant workers and strengthen the comprehensive service to the floating population [2]. On the other hand, the document requires professional and technical talents to go deep into the field and "write papers on the Earth" and solve the problem of public health and old-age insurance after professional and technical talents go to the countryside [3]. After professional and technical personnel go deep into the countryside, they will bring technical support to the water and soil environment management, mountain forest and windbreak forest management, and the optimization and regulation of farmland and water conservancy facilities in rural areas, effectively improve the ecological environment in rural areas, and realize the sustainable development of rural areas.

Li studied the actual value of the floating population in first-tier cities from the contribution of the floating population community construction in the place where the floating population is imported. When most cities treated

the consequences of the floating population input as a persistent social disease, the study pointed out that the inflow process of the floating population is of positive significance to the urban community construction [4]. Yang et al. pointed out in their research that the completeness of urban infrastructure and urban ecological environment directly affects the attraction of cities to the floating population. Perfect urban infrastructure and ecological environment protection of urban circle can effectively promote the input enthusiasm of the floating population [5]. The above two research results focus on the attraction of big cities to the floating population. Their common opinion is that the ecological environment of cities directly improves the attraction of cities to floating population, and the consequences of floating population entering cities, although it will bring some pressure to urban infrastructure, can also promote urban construction and development. Ma et al. put forward the collaborative development model of "industry population ecology." This study takes the population inflow of the Fujian tea industry as an example to explore the feasibility of attracting talent inflow after the development of rural industrialization [6]. Zhang et al. also discussed the attraction of rural industrialization to talents outside the region by taking the talent introduction in rural areas of Anhui Province as an example. Traditional Chinese medicine planting enterprises, agricultural product deep-processing enterprises, and forestry planting and particle board processing enterprises in Anhui have attracted high-quality talents [7]. That is, the way for rural areas to attract external talents with high academic qualifications, high professional titles, and high quality is to form agricultural production businesses into enterprises above the designated scale and attract relevant talents with agricultural enterprises. Xian pointed out that the aging trend of the society is increasingly serious, and the number of empty nesters and left-behind elderly under the influence of the urbanization trend is increasing, which hides the huge pressure on social pension. Therefore, how to implement the living security of the elderly and public health medical security is the top priority to achieve elderly care [8]. According to Li et al., the rise of cities is often accompanied by large-scale population flow, as the new generation of floating population has a profound impact on the social and urban economic development. Regarding the social integration of the new generation of population, it is conducive to attracting the inflow of young floating population in various regions and is of great significance to promoting the improvement of economic and employment structure and giving play to the positive role of population mobility [9].

This study will explore the impact of population flow between urban and rural areas and public health endowment insurance on the sustainable ecological environment in two aspects: the impact of population outflow process and population inflow process on the sustainable ecological environment.

2. Implementation Status of Public Health Endowment Insurance for China's Floating Population

2.1. Implementation Status of Endowment Insurance for High-Quality Migrant Workers. High-quality migrant workers are defined as those who have intermediate or high school (some skill certificates require a college or bachelor's degree or above), participated in the training of new professional farmers, obtained the training certificate, issued the certificate by the county-level new professional farmers, and hold the land-lost farmers with skill certificates issued by the relevant ministries and commissions or industry associations (associations) [10]. In order to improve the income level of the rural population, the state provides full or even excess subsidies for the training process of relevant certificates. At the same time, each township organization connects with the construction site and entrusts the labor dispatch company to carry out the collective labor dispatch work. Together with labor dispatch companies, township governments provide high-quality migrant workers with wage advances, social security withholding, collective rights protection, and other services [11].

The migrant workers registered residence in the four forms of social insurance. First, agricultural household members can participate in rural cooperative social insurance in the rural areas and communities where the registered residence is located. Second, the urban household registration personnel can participate in the cooperative social insurance of the urban residents in the community where the household register is located. In addition, the high-quality migrant workers participate in the social insurance for the employees of the enterprises, and they can choose to handle relevant social security accounts at the site. Relevant social security accounts can also be handled at the place of dispatch [12]. According to the statistical information released by the official website of the Ministry of Human Resources and Social Security, among all the floating population participating in social insurance, the selection results of various social insurance organization forms are shown in Figure 1.

In Figure 1, the rural cooperative social insurance accounts for 52%, the urban cooperative social insurance accounts for 23%, and the sum of the two accounts for 75%. These two models are counted as freelancers or unemployed by the Ministry of Human Resources and Social Security. This model has become the main form for high-quality migrant workers to choose social insurance. Migrant workers registered residence in the registered residence of

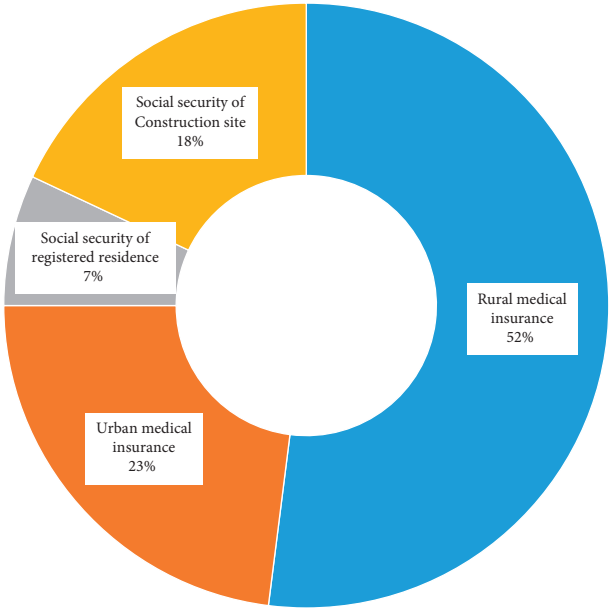

Figure 1: Social insurance organization form of high-quality migrant workers.

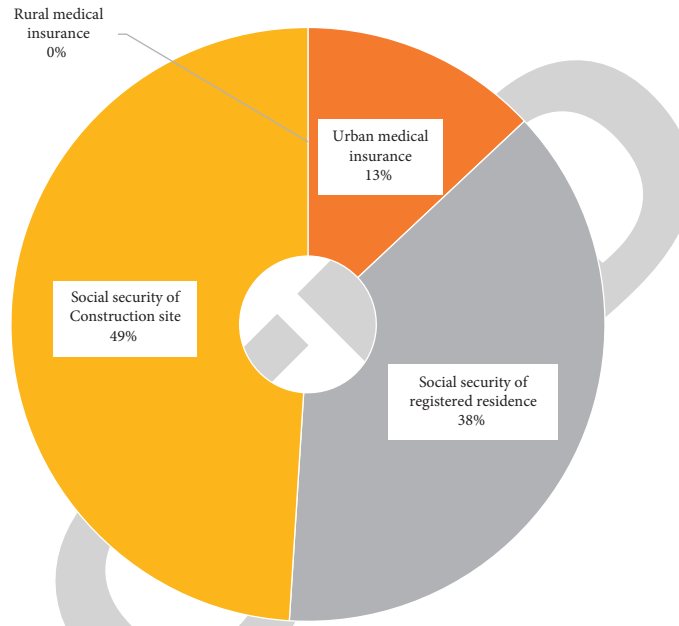

Figure 2: Social insurance organization form of introducing technical talents in rural areas.

18% of the staff members of the social insurance office, and the social insurance payment is only 7% of the household social insurance coverage. That is, high-quality migrant workers are unwilling to choose the workers' social insurance paid by the labor dispatching agencies in the registered residence area. The fundamental reason is that the partial withholding base of their medical insurance is relatively high and the reimbursement ratio is low.

2.2. Implementation Status of Endowment Insurance for the Introduction of Rural Technical Talents. According to the opinions on the revitalization of rural talents, all localities, under the strong supervision and strong subsidies of the government, introduce highly educated talents in agriculture, forestry, animal husbandry, aquaculture, veterinary medicine, food, agricultural finance, agricultural supply chain, and other fields, generally those with bachelor's degree or above, with certain agricultural project management experience and can work on the construction site for a long time [13].

At present, the coverage of endowment insurance is not high, and there is still a lot of room for improvement. Because the publicity is not in place, farmers keep the new farmers in a certain misunderstanding, and the subsidy level is also low, leading to the low enthusiasm of farmers to participate in the insurance, so we should steadily improve the important support of endowment insurance through the way of subsidies. In the same way, the above four forms of social insurance organizations are investigated. In the statistical information published on the official website of the Ministry of Human Resources and Social Security, the composition of social insurance when introducing technical talents in rural areas is shown in Figure 2:

Figure 2 shows city registered residence in the city of talent introduction, the social insurance organization for the employees in the rural area is about 49%, and the other social insurance organizations are the social security for workers in the household registration area (about 38%) and the registered residence free occupation social insurance (about 13%). Registered residence occupation social insurance comes from the social insurance of professional and technical personnel dispatched by the professional and technical personnel in the process of enterprise university research cooperation, while the registered residence freelance social insurance comes from the social insurance of the agricultural-related free engineer studio or the agricultural senior manager studio. The social insurance for site employees comes from the social insurance paid by professional and technical talents who directly handle the contract system.

3. Labor Dispatch and Existing Problems of Employee Pension Insurance System

3.1. Compliance with Labor Dispatch. An internet company's survey on the collective labor dispatch under the high-quality migrant workers project found that more than half of the high-quality migrant workers did not participate in the labor dispatch but chose to find their own jobs. Among the high-quality migrant workers participating in the collective labor dispatch, more than six pairs expressed dissatisfaction with the dispatch process. The current collective labor dispatch system of migrant workers with high quality does not fully meet the current collective needs of migrant workers. The study will conduct an independent investigation based on the survey results to find relevant problems.

Labor dispatch should inform the exchange of company basic situation and explain, understand the actual working

environment, jobs, if necessary to investigate, for the greatest interests of migrant workers, and the most important point is to stand on the intention of consider sending, confirm suitable for the type of work, respect the choice of migrant workers, according to the needs and standards of choosing and employing persons to arrange work, and ensure labor dispatch compliance strategy.

3.2. Enthusiasm for Rural Talent Introduction. The main institutions for the introduction of rural talents are planting and breeding agricultural enterprises and food processing enterprises in rural areas. These enterprises have small-scale and thin profits. If highly educated and high-quality technical talents are employed, although it can bring technological upgrading, it will also bring pressure on the cost of human resources [14]. Therefore, the enthusiasm of most small and microagricultural enterprises to introduce technical talents is not high. At the level of technical talents, because participating in the introduction project of technical talents requires stable employment in rural areas, these high-quality and highly educated talents need to leave the first- and second-tier cities with superior living environment and enter rural areas, so their personal enthusiasm is also low. Therefore, there are serious problems in the implementation path of the rural talent introduction process, resulting in low enthusiasm on both sides and low efficiency of project promotion.

4. Social Investigation and Analysis of People's Needs

4.1. Implementation Plan of Social Investigation. Through the network questionnaire method, a questionnaire was distributed to 3000 high-quality migrant workers participating in the training of high-quality migrant workers in six cities in Central China where labor export is concentrated. The respondents were asked to choose 1–5 levels from all descriptions, corresponding to 1–5 points in the statistical results.

Through the network questionnaire method, a questionnaire was distributed to 1000 fresh graduates from agricultural undergraduate colleges and universities, and questions and answers were put forward on the above two questions and environmental protection-related questions. Respondents were required to select 5 levels from 1–5 of all descriptions, corresponding to 1–5 points in the statistical results.

The data comparison method adopts the mode of bivariate *t*-check in SPSS software, and the calculation method is shown in formula (1)as follows:

$$t = \frac{\mu_1 - \mu_2}{\sqrt{\left((n_1 - 1)s_1^2 + (n_2 - 1)s_2^2\right)/(n_1 + n_2 - 2)\left((1/n_1) + (1/n_2)\right)}}. \quad (1)$$

Among them, μ_1, μ_2 is the arithmetic mean of sequence 1 and sequence 2. The calculation method is as follows in formula (2); n_1, n_2 is the number of elements in sequence 1 and sequence 2; s_1, s_2 is the standard deviation rate of sequence 1 and sequence 2; and the calculation formula is shown in formula (3) below.

$$\mu = \frac{1}{n}\sum_{i=1}^{n} x_i. \quad (2)$$

Among them, x_i is the ith measured value in the sequence; N is the number of elements in the sequence, corresponding to n_1, n_2 in formula (1) above; and μ is the calculation result of arithmetic mean, corresponding to μ_1, μ_2 in formula (1) above

$$s = \frac{1}{n-1}\sqrt{\sum_{i=1}^{n}(x_i - \mu)^2}. \quad (3)$$

Among them, the meaning of mathematical symbols is the same as formula (1) and formula (2) above; the smaller the t value obtained from the two columns of data, the greater the difference between the data. From the range of t value, when $t < 10.000$, it is considered that the data are statistically different; on the contrary, it is considered that the data are statistically consistent. SPSS built-in algorithm is used to calculate the reliability p value of synchronous output when t value is obtained. When $p < 0.05$, it is considered that the statistical result is statistically significant. When $p < 0.01$, it is considered that the statistical result is statistically significant. The smaller the p value, the higher the data reliability.

4.2. Demand Analysis of Landless Farmers. Considering the age-group of migrant workers, the questionnaire survey results of landless farmers participating in high-quality migrant workers' project are shown in Tables 1 and 2:

In Table 1, people aged 25 to 35 years are more likely to choose independent employment, while those under 25 years old are more dependent on labor dispatch, and those over 36 years old are more dependent on labor dispatch. All data have $t < 10.000$, $p < 0.05$, with a credible statistical difference, while the statistical results of people under 35 years old have $t < 10.000$, $p < 0.01$, with a significant statistical difference. That is, the current promotion of high-quality migrant workers' project, including skill training subsidies for migrant workers and collective labor dispatch, focuses more on young migrant workers under the age of 25 years.

In Table 2, as the age of migrant workers increases, their intention to participate in local employment also gradually increases, and their intention to go to other places for employment continues to weaken.

4.3. Demand Analysis of Agricultural Scientific and Technological Talents. Considering the academic grouping of agricultural scientific and technological talents, the questionnaire survey results for agricultural scientific and technological talents are shown in Tables 3 and 4:

Table 1: Distribution map of employment mode intention of landless farmers of different ages (%).

Grouping	<25	25–35	>36	Total
Independent employment	34.7	72.8	45.4	58.3
Dispatch employment	65.2	27.2	54.6	41.7
t	2.276	2.189	6.742	7.295
p	0.008	0.007	0.016	0.019

Table 2: Distribution map of employment intention of land-lost farmers of different ages (%).

Grouping	<25	25–35	>36	Total
Local employment	28.5	39.2	57.4	51.1
Foreign employment	71.5	60.8	42.6	48.9
t	1.052	3.713	8.149	12.501
p	0.002	0.006	0.009	0.012

Table 3: Distribution map of employment intention of agricultural scientific and technological talents (%).

	Specialty	Undergraduate	t	p
Core city circle	36.2	38.6	7.292	0.006
Small city	41.3	33.6	5.307	0.005
Front line of agriculture	22.5	27.8	6.247	0.007

Table 4: Distribution map of employment intention of agricultural scientific and technological talents in the front line of agricultural production (%).

	Specialty	Undergraduate	t	p
Scale agriculture	3.6	3.1	6.792	0.005
Agricultural processing integration	24.7	21.6	8.925	0.009
Agricultural tourism integration	35.2	31.3	8.131	0.008
Ecological agriculture	12.4	9.4	5.294	0.006
Supply chain or commerce	24.1	34.6	1.083	0.001

In Table 3, all data have $t < 10.000$, $p < 0.01$, with a significant statistical difference. According to the data, only 22.5% to 27.8% of agricultural college graduates hope to work in frontline units of agricultural production, while agricultural college graduates focus more on going to small and medium-sized cities to engage in teachers, civil servants, and other occupations, and agricultural college graduates focus more on going to core big cities to engage in it, e-commerce, finance, and other occupations. Therefore, although there are more than 10000 agricultural graduates in colleges and universities every year, fewer graduates can actually participate in the construction of the front line of agricultural production. By analyzing the employment intention of graduates willing to go to the front line of agricultural production, Table 4 is obtained.

In Table 4, all data have $t < 10.000$, $p < 0.01$, with a significant statistical difference. The data show that the employment intention of large-scale agricultural enterprises is weak, followed by ecological agricultural enterprises. Most large-scale agricultural enterprises are central enterprises or listed enterprises, and the entry threshold is high, so most agricultural college graduates quit in the face of difficulties. Ecological agricultural enterprises are generally small in scale and are mostly combined with new sales models. They generally adopt the full-time sales management model, and the enterprise stability and poststability are low. Therefore, it is difficult for graduates to adapt. In order to make it easier to observe the data, the data in Table 4 above are visualized to get Figure 3.

In Figure 3, the three agricultural production frontline employment directions with the highest employment intention are agricultural tourism integrated enterprises, with a total employment intention of 66.5%, followed by agricultural product supply chain or agricultural finance enterprises, with a total employment intention of 58.6%, and then agricultural processing integrated enterprises, with a total employment intention of 46.3%. It can be found that graduates of this college pay more attention to the stability of work and after when they choose jobs in the front line of agricultural production.

4.4. Demand Analysis of Employed Persons for Living Environment. The environmental factors should be investigated that may affect the employment direction of the floating population (including migrant workers and

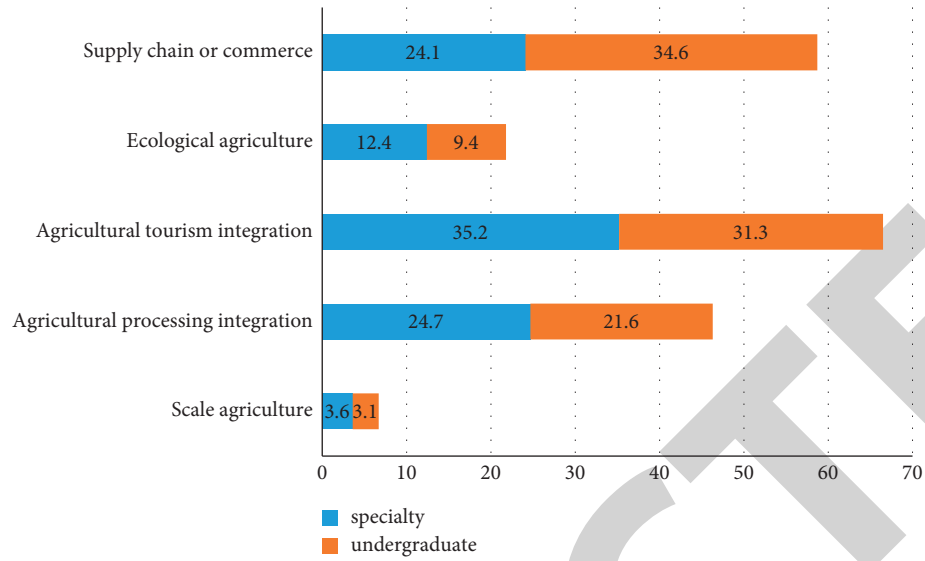

Figure 3: Distribution of intention of agricultural college graduates to go to the front line of agricultural production.

agricultural professional and technical talents), including regional climate, air quality, transportation convenience, perfection of medical and educational facilities, and wage level (calculated by the ratio of annual salary-to-house price). The comprehensive statistical results of relevant questions are shown in Table 5:

In Table 5, with the increase in educational background, the employment city choice intention of the relevant floating population has a linear change trend. For example, with the increase in educational background, the demand for climate and air quality and educational supporting facilities increases, while the demand for transportation convenience, wage level, and medical supporting facilities decreases. In order to more intuitively observe the above data, the above data should be visualized to obtain Figure 4.

In Figure 4, the main demand of all floating population flowing into the city comes from the ratio of annual salary-to-house price (wage level) of the city. If the per capita annual salary is an economic index and it is difficult to adjust in the short term, the local government should reasonably control the house price and improve the ratio of annual salary to the house price, which will effectively enhance the attraction of the city to the floating population. In particular, if local governments want to choose the return of migrant workers to promote the large-scale development of local agricultural industrialization, they should carry out urban environmental infrastructure from the above-mentioned annual salary-to-house price ratio, medical facilities, and transportation convenience. If they want to attract highly educated agricultural talents, they should carry out urban environmental construction from the aspects of education facilities and ecological environment governance. It can be considered that the construction of a sustainable urban ecological environment includes not only natural ecological problems such as climate and air quality but also many economic, geographical, and ecological problems.

5. Reform Strategy of Public Health Endowment Insurance System for Floating Population in China

5.1. Labor Dispatch System Should be Transformed into Labor Service System. In the social survey, it is found that migrant workers' guidance and coordination of labor export work are aimed at large enterprises. On a better working platform, seeking the impact of the establishment of labor cooperation and labor dispatch system on the labor service system and actively exploring ways to solve the impact can effectively mobilize the enthusiasm of workers' dispatch work, safeguard the interests of migrant workers, and reduce the resistance of migrant workers. Moreover, the direction of collective labor dispatch is mostly miscellaneous workers on the construction site and general workers on the production line, and few can be dispatched to the professional skills' counterpart positions of high-quality migrant workers, which exacerbates the resistance of migrant workers to collective labor dispatch.

Observing the process of collective labor dispatch from the government side, we will find that the government mainly has two needs: one is to maintain the stability of landless farmers through collective labor dispatch, and the other is to realize the local collection and payment of individual income tax and surtax through collective labor dispatch. If the process is completely handed over to enterprises, and the government only promotes collective labor dispatch from the aspect of intergovernmental docking, the above disadvantages will be avoided to a certain extent. Most migrant workers trust their village foremen to lead the team to find jobs. The government can encourage such foremen to establish formal enterprises, standardize their operations, and give subsidies to labor dispatch companies to these village-run enterprises.

The social environment is an important part in the process of sustainable environmental control. The

Table 5: Demand for the living environment of employed persons.

	Migrant worker	Agricultural junior college	Undergraduate course in agriculture
Climate	1.6	2.2	5.5
Air quality	2.8	2.9	5.7
Convenient transportation	23.6	21.8	19.8
Medical facilities	12.5	12.3	11.9
Education supporting	3.2	17.5	24.4
The wage level	56.3	43.3	32.7

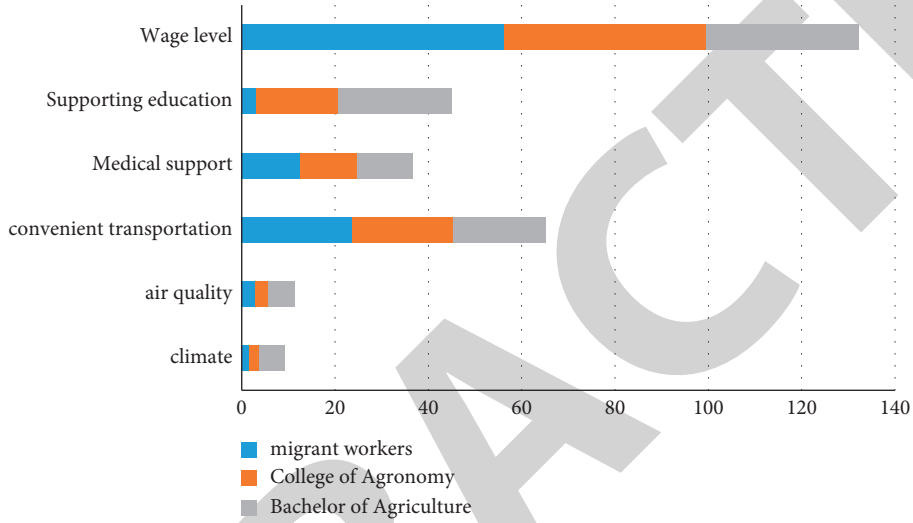

Figure 4: Statistical chart of demand for the living environment of employed persons.

government should go deeper into the grassroots level in relevant work, do a good job in grassroots research, and continuously improve the work process, so as to truly realize the stability maintenance of landless farmers through the high-quality migrant workers' project.

5.2. The Construction of Urban Ecological Environment Has a Direct Effect on the Attraction of Floating Population. The urban ecological environment includes not only the natural environment but also the economic and geographical environment of the city. For example, urban infrastructure construction, urban public transport, and intercity transportation systems need to be continuously improved, urban education and medical supporting systems need to be continuously constructed, and urban living material support capacity also needs to be invested. If the urban economic and geographical environment cannot be synchronized with the natural environment, it is difficult to effectively control the return of migrant workers and let alone effectively attract the inflow of high-quality and highly educated talents.

The trend of population flow in rural areas is mainly reflected in two points: one is that landless farmers with low educational level flow out of rural areas; the other is that highly educated and high-quality talents enter agricultural enterprises for employment, and private capital continues to flow into rural areas for investment. Over the past five years, agriculture has developed into a blue ocean industry, with a significantly higher return on investment than other industries, but the investment risk is also high. The traditional farmers under the small-scale peasant economic model are difficult to make profits in the new countryside, and the small-scale peasant thought is difficult to bear such a large investment risk, so this exchange population flow appears.

However, the infrastructure level in rural areas is poor, the ability of living security is not strong, and the economic and geographical environment is relatively bad. It will be more difficult to allow high-quality talents to flow to rural areas. In the new rural construction, we should focus on rural infrastructure, and the infrastructure process should not damage the rural natural environment. This puts forward higher requirements for the level of urban infrastructure planning.

5.3. The Inflow of Floating Population Can Effectively Improve the Local Urban Ecological Environment. Relevant studies have pointed out that for the first- and second-tier cities, the inflow process of migrant workers can effectively promote the basic service capacity of cities and effectively increase grassroots labor resources. For rural areas, the inflow of high-quality and highly educated talents can effectively improve the local economic and industrial

Hindawi
Journal of Environmental and Public Health
Volume 2023, Article ID 9829732, 1 page
https://doi.org/10.1155/2023/9829732

Retraction

Retracted: Research on Sino Japanese Comparative Literature from the Perspective of Sustainable Ecological Environment

Journal of Environmental and Public Health

Received 27 June 2023; Accepted 27 June 2023; Published 28 June 2023

This article has been retracted by Hindawi following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of one or more of the following indicators of systematic manipulation of the publication process:

(1) Discrepancies in scope

(2) Discrepancies in the description of the research reported

(3) Discrepancies between the availability of data and the research described

(4) Inappropriate citations

(5) Incoherent, meaningless and/or irrelevant content included in the article

(6) Peer-review manipulation

The presence of these indicators undermines our confidence in the integrity of the article's content and we cannot, therefore, vouch for its reliability. Please note that this notice is intended solely to alert readers that the content of this article is unreliable. We have not investigated whether the authors were aware of or involved in the systematic manipulation of the publication process.

Wiley and Hindawi regrets that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our own Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

References

[1] Q. Fang, "Research on Sino Japanese Comparative Literature from the Perspective of Sustainable Ecological Environment," *Journal of Environmental and Public Health*, vol. 2022, Article ID 5396135, 6 pages, 2022.

Hindawi
Journal of Environmental and Public Health
Volume 2022, Article ID 5396135, 6 pages
https://doi.org/10.1155/2022/5396135

Research Article

Research on Sino Japanese Comparative Literature from the Perspective of Sustainable Ecological Environment

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Received 6 May 2022; Revised 20 May 2022; Accepted 6 June 2022; Published 21 June 2022

Academic Editor: Sivakumar Pandian

Objective. This study promotes the comparison and research of Chinese literature and Japanese literature from the perspective of the ecological environment of sustainable development. *Methods*. This study analyzes and compares the differences in the literary cultures of different countries. After the analysis, it is found that the literary culture has never been solid and conservative. We should look at the national literary culture and national differences from the perspective of development. *Results*. The results show that in the research of Chinese and Japanese comparative literature from the perspective of a sustainable ecological environment, it is found that through the comparison and analysis of concept differences, thinking differences, behavior differences, and language differences in Chinese and Japanese comparative literature, it can be seen that Chinese literature has a more far-reaching impact on national quality education than Japanese literature, which is more progressiveness and has a reference value. *Conclusion*. The analysis and research of Chinese and Japanese comparative literature cannot be underestimated in promoting the development and progress of the country, and it can provide a good foundation for promoting the establishment of a bridge of friendly exchange between Chinese and Japanese nationalities so as to shorten the distance between each other.

1. Introduction

The sustainable development of the ecological environment is closely related to the development of the social economy. The ecological environment provides essential resources for human survival and development. The Chinese nation has always respected and loved nature. The 5000 year old Chinese civilization is pregnant with a rich ecological culture. The prosperity of ecology leads to the prosperity of civilization, and the decline of ecology leads to the decline of civilization. Civilization is the historical accumulation of culture, and culture is the external manifestation of civilization. The development process from agricultural civilization to industrial civilization to ecological civilization is also a process of continuous deconstruction and reconstruction of the ecological culture paradigm [1]. Ecological culture is the spiritual achievement of the harmonious development between man and nature, the spiritual link of maintaining the relationship between man and nature, and the spiritual force of building ecological civilization. China has entered a new era, comprehensively promoting the construction of economic, political, cultural, social, and ecological civilization. Its foundation is the construction of ecological civilization, and what guides the construction of ecological civilization is ecological culture. The development of cultural industry is an important part of national construction. With the rapid development of the social economy, all countries have begun to pay attention to the construction of cultural industry [2]. The ecological culture of different civilization backgrounds has its own typical characteristics in essence, theory and method. A profound grasp of the transformation law of ecological culture is the internal requirement for accurately grasping the essence of the construction of ecological civilization.

If a country's cultural development wants long-term and progress, it is necessary to correctly grasp the relationship between national literature and world literature. The construction of national literature is inseparable from the theory and method of comparative literature [3]. The literature of each nation should not become a closed and independent

individual but should be understood and analyzed from the perspective of comparison and influence. Since modern times, there has been a relatively close exchange between Chinese literature and foreign literature. It is found that literary works of different countries have their own characteristics. It is not clear which is better or worse on the macro level. It can only be said that each has its own merits. Therefore, the literary works of any country have reading value and should be analyzed accordingly [4]. Literary works are not only the crystallization of language, but also record the history and social changes of a country. Literature is the product of worldwide circulation. Comparative literature studies a country's literary phenomena and related cultural phenomena from the perspective of borderlessness. Comparative literature puts the literature of various countries into this overall structure for understanding and comparison, and reveals and grasps the laws and relations of literature. The gradual deepening of reform and opening up and the all-round development of the economy have built a good environment for the development of Chinese culture, which has led to the rapid development of China's comparative literature research. Chinese and Japanese comparative literature has become a hot field of comparative literature research [5]. China and Japan are neighbors separated by a strip of water. With the migration of history and the precipitation of time, the two countries have both similarities in culture and different cultural characteristics [6]. In ancient times, from the dispatch of Sui envoys, the monks entering the Song Dynasty, Confucianism in the Tang Dynasty, and the custom of drinking tea in the Song and Yuan Dynasties were introduced into Japan. In terms of material and spiritual aspects, China was comprehensively affecting Japan and improving its social development and progress. In modern times, Japan's development was faster than that of China. When China lagged behind the world, it also got the influence of Japan and indirectly the advanced civilization of the west through Japan. From the communication of Chinese language and characters to clothing and means of transportation, China and Japan influenced and contrasted each other in their existing customs and cultures.

2. An Analysis of the Current Situation of Comparative Literature between China and Japan

The exchange history of Chinese and Japanese literature is bounded by the Meiji Restoration, and the comparative literature research between China and Japan is carried out from the two fields of Chinese and Japanese ancient literature and Chinese and Japanese modern literature. The important achievement of Chinese and Japanese comparative literature is the comparative study of Chinese and Japanese ancient literature. Since Japan entered the Meiji Restoration, Western culture has been continuously introduced into Japan, which became a new thing and a turning point in the trend of Japanese literature, leading to the rise of Japanese modern literature [7]. In the early 1980s, a group of scholars such as Jiang Xijin, Lin Huanping, and Sun Xizhen began to study the relationship between Chinese new literature and Japanese modern literature, which is also the backbone of Chinese and Japanese modern comparative literature research. The comparative study of Chinese and Japanese modern literature has taken a completely different path from the comparative study of Chinese and Japanese ancient literature. Because of the enlightenment of Japanese modern literature to Chinese modern literature, the foothold of Chinese modern literature is Chinese modern literature. Although the characters in Japanese literature and culture evolved from Chinese characters, great changes have taken place in the writing and content expression after a long time of development and change. For foreign literature and culture, we should always maintain a modest attitude, learn and think, "take the essence and discard the dross." Since the 1990s, there have been a number of influential works on comparative literature. For example, Wang Xiangyuan's comparative theory of Chinese and Japanese modern literature has found some new problems in Chinese and Japanese modern literature from a new perspective. Zhang Fugui and Jin Conglin's comparative study of Chinese and Japanese modern literary relations clearly and comprehensively combs the history of Chinese and Japanese modern literary relations and exchanges in the order of historical occurrence, and Hu Lingyuan's resonance and development of civilization—A Study of Sino Japanese cultural relations, The book discusses the significance of Japanese literature to modern Chinese literature and reflects on Chinese and Japanese culture. Cross-cultural interpretation pursues equal exchanges and mutual learning between different cultures, so it plays a positive role in the external communication of Chinese culture [8]. Ting correctly understands the interaction between different literature, which is of great significance for absorption, sublation, and innovation after influence. Only in this way can we correctly understand the national characteristics of their respective literature and have prominent significance in the study of Chinese and Japanese comparative literature [9].

3. Analysis of the Differences in Various Aspects of Chinese and Japanese Comparative Literature

3.1. Conceptual Differences between Chinese and Japanese Comparative Literature. Culture is borderless and excellent. No matter which country it is from, it can be used for reference and recognized by all countries in the world. However, culture is different, and different countries and regions have distinctive characteristics in all aspects [10]. Conceptual differences are reflected in the process of subtle influence and the influence of the surrounding environment. They are formed through observation, learning, and personal experience. They are generated from a specific culture and have their own views, judgment, and attitude towards things. Therefore, concept is not only the criterion of people's daily life and activities but also a yardstick to judge their words and deeds. The main reason for the conceptual difference between Chinese and Japanese comparative

literature is that China has always believed in Confucianism since ancient times, with "benevolence" as the core of the thought. After Confucianism spread to Japan, it chose "ceremony" as the core thought. This is the initial reason for the formation of the concept difference of comparative literature between China and Japan, but Japan's literature and culture lack the thickness of inheritance. China's literature and culture have experienced thousands of years of precipitation and accumulation. The thought has long been deeply rooted, and the ideological depth has long reached an unreachable height. Through the comparison of the differences in the concept of comparative literature between China and Japan in terms of national cohesion, family honor, and personal values, this paper analyzes, discusses, and studies the two different literary and cultural directions of Chinese literature and Japanese literature as shown in Table 1.

In Table 1, through the analysis of the conceptual differences between Chinese and Japanese comparative literature under the two different literary and cultural directions in the above table, it can be seen that in terms of national cohesion and personal values, Chinese literature has a higher influence on the people than Japanese literature. In terms of family honor, Japanese literature has a deeper impact on the people than Chinese literature.

In order to better reflect the comparison results of the conceptual differences between Chinese and Japanese comparative literature under the analysis of two different literary and cultural directions, the data comparison results in Table 1 are visualized, and Figure 1 is obtained.

Figure 1 shows the comparison results of the conceptual differences between Chinese and Japanese comparative literature under the analysis of two different literary and cultural directions. Chinese literature has far more influence on the people in terms of national cohesion and personal values than Japanese literature. Japanese literature has a higher influence on the people in terms of family honor than Chinese literature. The influence of Chinese literature and culture on their nationals is broader than that of Japanese literature and culture and has better ideological guidance for their nationals. It shows that in different aspects, two different literary cultures have their own strengths and weaknesses.

3.2. Thinking Differences between Chinese and Japanese Comparative Literature. The thinking difference is reflected in the problem and implementation, as well as in the logical ability. The ability is improved by forming independent systematic thinking, which gradually opens the thinking gap in these processes. Therefore, thinking is the reflection of people's brain on objective reality. It is a unique spiritual activity of people, which is produced from a large number of social practices. The main reasons for the formation of the thinking difference between Chinese and Japanese comparative literature is because of the country's region, the country's productivity, and the country's unique cultural thought. China has a vast region, rich and diverse resources, and a unique national culture; however, Japan's territory is narrow, the types of resources are scarce and limited, and most of its national culture is a mixture of learning from and accepting the cultural ideas of other foreign countries. Therefore, China's literature and culture has the style of a big country, while Japan's culture is relatively chaotic and complex. Under the influence of this literary thought, Japanese people's thinking mode is more conservative and old-fashioned. By comparing the thinking differences of Chinese and Japanese comparative literature in terms of national self-discipline, interpersonal relationship and communication mode, and analyzing, discussing, and studying the two different literary and cultural directions of Chinese literature and Japanese literature, Table 2 is obtained.

In Table 2, through the analysis of the thinking differences between Chinese and Japanese comparative literature under the two different literary and cultural directions in the above table, it can be seen that in the three aspects of national self-discipline, interpersonal relationships, and interpersonal communication mode, Chinese literature has a higher influence on the people than Japanese literature and a deeper influence than Japanese literature.

In order to more intuitively reflect the comparison results of thinking differences between Chinese and Japanese comparative literature under the analysis of two different literary and cultural directions, the data comparison results in Table 2 are visualized, and Figure 2 is obtained.

Figure 2 shows the comparison results of the conceptual differences between Chinese and Japanese comparative literature under the analysis of two different literary and cultural directions. The influence and influence of Chinese literature on the people in the three aspects of national self-discipline, interpersonal relationships, and interpersonal communication mode are far greater than that of Japanese literature. It shows that Chinese literature and culture are more suitable as the thinking guidance of the people and are more conducive to the development of national conditions.

3.3. Behavioral Differences between Chinese and Japanese Comparative Literature. The fundamental reason for the formation of the difference between Chinese and Japanese comparative literature is Confucianism, but the reason for the formation of the behavior difference between Chinese and Japanese comparative literature is also composed of other factors, such as geographical environment, national geographical location, and so on, which lead to great differences in people's behavior and activities. Behavioral differences are reflected in the innate physiological quality and social environment. Through later education and social practice activities, they show different behaviors and activities dominated by ideas. The basic reason for the formation of the difference between Chinese and Japanese comparative literature is Confucianism, but the reason for the formation of the behavioral difference between Chinese and Japanese comparative literature is also composed of other factors, such as the geographical environment and location of the country, which lead to great differences in people's behavior and activities. Through the comparison of

Table 1: Conceptual differences between Chinese and Japanese comparative literature.

Group	National cohesion (%)	Family honor (%)	Personal values (%)
Chinese literature	95.40	79.60	87.30
Japanese literature	89.60	92.80	76.90

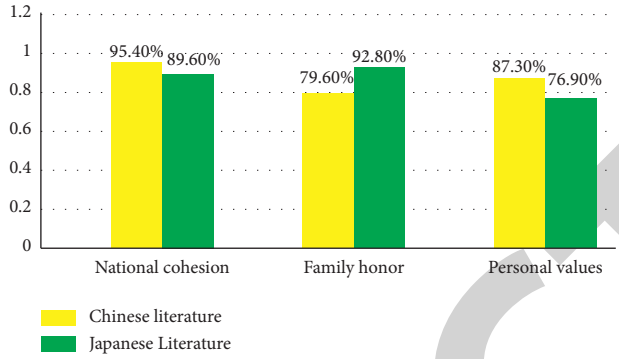

Figure 1: Visualization of conceptual differences between Chinese and Japanese comparative literature.

Table 2: Data of thinking differences in Japanese comparative literature.

Group	National self-discipline (%)	Interpersonal relationship (%)	Interpersonal style (%)
Chinese literature	94.20	86.40	91.30
Japanese literature	87.60	78.20	88.70

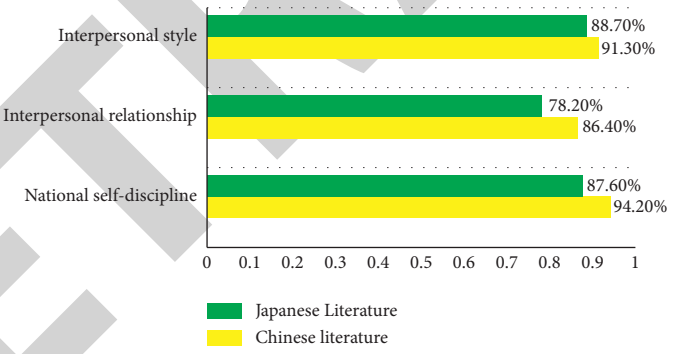

Figure 2: Visualization of thinking differences in Japanese comparative literature.

thinking differences between Chinese and Japanese comparative literature in terms of integrity consciousness, time concept consciousness, and work attitude consciousness, and through the analysis, discussion, and research of the two different literary and cultural directions of Chinese literature and Japanese literature, Table 3 is obtained.

In Table 3, through the analysis of the thinking differences between Chinese and Japanese comparative literature under the two different literary and cultural directions in the above table, it can be seen that Japanese literature has a higher influence on people than Chinese literature in terms of time concept consciousness and work attitude consciousness. In the sense of honesty, Chinese literature has a deeper influence on people than Japanese literature.

In order to more intuitively see the behavioral difference comparison results of Chinese and Japanese comparative literature under the analysis of two different literary and cultural directions, the data comparison results in Table 3 are visualized, and Figure 3 is obtained.

Figure 3 shows the comparison results of the conceptual differences between Chinese and Japanese comparative literature under the analysis of two different literary and cultural directions. Japanese literature has a better influence on the people in terms of time awareness and work attitude awareness than Chinese literature. Chinese literature has a deeper influence on the people in terms of integrity consciousness than Japanese literature. It shows that different literary cultures have different emphases on the influence of

Table 3: Data table of behavioral differences between Chinese and Japanese comparative literature.

Group	Honesty consciousness (%)	Time concept consciousness (%)	Work attitude awareness (%)
Chinese literature	93.90	78.20	86.40
Japanese literature	86.30	86.90	92.80

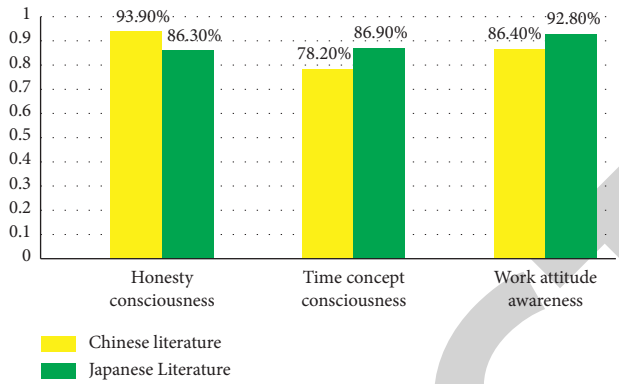

Figure 3: Visualization of behavioral differences between Chinese and Japanese comparative literature.

people's behavior. Each country has its own literary culture and behavior mode, which cannot be generalized.

3.4. Language Differences between Chinese and Japanese Comparative Literature. The differences in the way of thinking and culture are reflected in the differences in the way of thinking and life. The main reasons for the language differences between Chinese and Japanese comparative literature is the differences in the use of vocabulary and the specific ways of language expression. Through the comparison of thinking differences between Chinese and Japanese comparative literature in terms of vocabulary differences, language differences, and expression methods, this paper analyzes, discusses, and studies the two different literary and cultural directions of Chinese literature and Japanese literature, and obtains Table 4.

In Table 4, through the analysis of the thinking differences of Chinese and Japanese comparative literature under the two different literary and cultural directions in the above table, it can be seen that in terms of vocabulary differences and language differences, Chinese literature has a higher influence on the people than Japanese literature. In terms of differences in expression, Japanese literature has a deeper impact on the people than Chinese literature.

In order to more intuitively reflect the behavior difference comparison results of Chinese and Japanese Comparative Literature under the analysis of two different literary and cultural directions, the data comparison results in Table 4 are visualized, and Figure 4 is obtained.

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4. Discussion

Both China and Japan have long literary and cultural traditions. With the background of opening to the outside world and the development of global integration, cultural exchanges between countries are becoming more and more frequent. With the joint efforts of China and Japan, the literary relations between the two countries have developed rapidly. Although the two countries have various differences in the mode of cultural inheritance, it is undeniable that the national cultures of China and Japan affect and permeate each other. Wang Z recalled that in the 20th century, the study of Chinese and Japanese comparative literature has experienced a long period of exploration and rapid development, and has made good achievements. Looking forward to the 21st century, the study of Chinese and Japanese comparative literature has been advancing on the road of vigorous development [11]. From the birth of comparative literature to the formation of the Chinese School reflects the change of research direction and the continuous expansion of the research vision of comparative literature. Although Chinese comparative literature started relatively late, it is playing an increasingly important role on the stage of world comparative literature [12]. No matter how the world changes, the cultural foundation of Chinese literature and Japanese literature cannot be changed. Their national aesthetics and values inherit the tradition in progress and revise and develop it in inheritance. Chinese comparative literature develops slowly under the background of globalization. In its

Hindawi
Journal of Environmental and Public Health
Volume 2023, Article ID 9898740, 1 page
https://doi.org/10.1155/2023/9898740

Retraction

Retracted: Evaluation of Knowledge, Attitude, and Practice of Health Practitioners towards Fertility Preservation in Cancer Patients in an Environmental Region of Saudi Arabia

Journal of Environmental and Public Health

Received 27 June 2023; Accepted 27 June 2023; Published 28 June 2023

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(5) Incoherent, meaningless and/or irrelevant content included in the article

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References

[1] R. Ahmad Sindi, M. Salem Bagabas, L. Mamdoh Al-Manabre, R. Zahi Al-Sofee, R. Yousef Rednah, and S. Meshal Al- Jahdali, "Evaluation of Knowledge, Attitude, and Practice of Health Practitioners towards Fertility Preservation in Cancer Patients in an Environmental Region of Saudi Arabia," *Journal of Environmental and Public Health*, vol. 2022, Article ID 6404837, 11 pages, 2022.

Hindawi
Journal of Environmental and Public Health
Volume 2022, Article ID 6404837, 11 pages
https://doi.org/10.1155/2022/6404837

Research Article

Evaluation of Knowledge, Attitude, and Practice of Health Practitioners towards Fertility Preservation in Cancer Patients in an Environmental Region of Saudi Arabia

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Received 24 April 2022; Revised 5 May 2022; Accepted 24 May 2022; Published 6 June 2022

Academic Editor: Sivakumar Pandian

Background. Cancer patients face multiple challenges, such as infertility caused by exposure to gonadotoxic agents and gonadal irradiation during cancer treatment. Little is known about the health practitioners' knowledge and practice regarding fertility preservation and its available options in Saudi Arabia. Thus, this study is designed to evaluate the level of knowledge, attitude, and practice (KAP) towards fertility preservation in cancer patients among health practitioners in an environmental region in Saudi Arabia. *Methods.* The cross-sectional study was carried out between September 2020 and January 2021. A self-administered questionnaire was distributed among health practitioners from a variety of specialties who work closely with cancer patients. *Results.* Out of 100 participants, 90% need more knowledge about fertility preservation. The lack of fertility preservation clinics in the patient's area and its unaffordable expenses significantly influenced the health practitioners' attitude towards fertility preservation discussion with cancer patients. The results revealed that 92% of the participants agreed that the Saudi Ministry of Health should establish practice guidelines and provide fertility preservation services for cancer patients. *Conclusions.* The present study showed that clinical practitioners' knowledge remains insufficient. Education of health practitioners and the establishment of practice guidelines and fertility preservation clinics for cancer patients are required.

1. Background

Cancer is the second-highest cause of death globally, resulting in millions of deaths all over the world. According to the Global Cancer Observatory (GCO), a platform that follows The World Health Organization (WHO), approximately about 19 million new cancer cases worldwide were recorded in 2020, with 9.9 million deaths across both genders [1]. In Saudi Arabia, 27,885 patients were diagnosed, and 13,069 deaths were reported from both genders in 2020. Among females, the most common types of cancer were breast cancer, followed by thyroid cancer and colorectal cancer. In contrast, among male patients, colorectal cancer was the most prevalent, followed by Non-Hodgkin lymphoma (NHL) and leukemia [2].

Cancer patient faces multiple challenges, along with being diagnosed with cancer. In the past, the main priority for cancer patients was to survive cancer despite any other complications. However, the focus now has changed from treating cancer alone to providing treatment and avoiding long-term consequences, which resulted from cancer therapy such as infertility [3]. According to The World Health Organization (WHO), infertility is defined as the inability or failure to establish pregnancy after one year of trying with regular unprotected sexual intercourse [4]. Infertility rises among cancer survivors, and it is usually associated with significant social, psychological, and economical effects. Preserving cancer patients' fertility before being treated for cancer is highly recommended [5].

The American Society of Clinical Oncology (ASCO) recommended that the possibility of infertility and fertility preservation options must be discussed with a cancer patient. In addition, a cancer patient should be referred to a fertility preservation clinic for consultation before cancer treatment [6, 7]. Despite these fertility preservations guidelines and regulations, a large number of previous studies reported that some health practitioners including oncologists are lacking awareness regarding fertility preservation options before cancer treatments. Therefore, the number of patients' referrals to fertility preservation clinics remains low [8–10].

In Saudi Arabia, the patient bill of Rights and Responsibilities by the Saudi Ministry of Health (MOH) righted that the patient must be informed regarding the possibility of infertility due to cancer and its negative effects and referred to an infertility consultant before undergoing cancer therapy [11–13]. However, fertility preservation of cancer patients is still a challenging issue, and the practice of referral and consulting is not yet fully adapted among Saudi health practitioners.

1.1. Cancer Therapy and its Impacts on Fertility. Cancer and its further treatments may induce negative impacts on an individual's fertility. This includes fatigue, loss of sexual desire, and temporal or permanent infertility [5]. These effects are mainly depending on the cancer type, stage, and site. In addition, it depends on the provided type of cancer therapy as the following:

1.1.1. Chemotherapy. It is a group of cytotoxic drugs which are used to shrink the tumor before surgery or terminate the cancer cells. However, it has considerable side effects on the fertility of both males and females [14–16]. Chemotherapy treatment can either reduce fertility or lead to infertility. Its impacts depend on several factors, including the type of cancer and stage, dose and duration, and patient's age. In females, the number of primordial follicles is fixed since birth [17, 18]. The chemotherapy breaks down the DNA strands, increases apoptosis, and decreases stromal function [13]. This leads to changes or stopping of the menstrual cycle temporarily. However, this effect is revised after stopping cancer treatment. Although returning normally to the menstrual cycle does not mean returning to fertility since the ovarian reserve could be low or diminished. Treating cancer by chemotherapy could also stop the menstrual cycle permanently, leading to infertility in some cases [13].

Whereas in males, chemotherapy reduces testosterone levels, affecting sexual functions [19]. Moreover, it damages the spermatogenesis process, which reduces the number of sperms leading to azoospermia [20, 21]. Azoospermia is a medical condition in which the patient has no sperm in his ejaculate. There are two types of Azoospermia: non-obstructive and obstructive azoospermia. The former refers to the absence of sperm in the ejaculate due to the failure of sperm production, whereas the latter refers to the absence of spermatozoa in the ejaculate despite normal spermatogenesis [22, 23].

1.1.2. Radiotherapy. Another widely adopted option for treating cancer, radiotherapy is where an ionized radiation beam is used to reduce the number of cancer cells and destroy it by damaging their DNA [24, 25]. Radiotherapy has a significant effect on fertility, and this mainly depends on several factors including the site of radiation, the age of the patient, and the dose of treatment. In the case of ovarian cancer, it has been shown that pelvic irradiation could cause a loss of elasticity of the uterus and blood vessels in the endometrium, which leads to miscarriage and pregnancy loss [12]. Moreover, the age of the patient plays a role in the impact of the radiation. A previous study has demonstrated that young patients showed fewer side effects on their fertility and a higher recovery rate than older patients [14]. Furthermore, high doses of pelvic irradiation may greatly damage the sperm and oocytes [13]. In females, when radiation therapy is focused on the pelvic region, it affects the ovaries by destroying the ovarian follicles' DNA, which, therefore, decreases the ovarian follicular number and affects the hormone production. This leads to failure of the uterine function and early stages of menopause. Uterine dysfunction may also be associated with the reduction in uterus size and endometrium damage.

In males, cancer radiotherapy affects the testes and epididymis. It has been demonstrated that pelvic irradiation decreases sperm motility and count by impairing sperm production and increasing the rate of mortality and apoptosis. In addition, radiotherapy may induce a mutagenic effect by increasing sperm DNA abnormalities. Consequently, lower fertilization rate, hypo-fertility, or infertility may occur [26, 27].

1.1.3. Surgical Treatment. Surgical treatment is widely used to treat uterine cancer and ovarian cancer in females and testicular cancer in males [13]. In cases of ovarian cancer, ovaries removal leads to changes in the vagina and early menopause. As a result, this will impact women's confidence and influence their psychological state [5].

In cases of testicular cancer, orchidectomy or testicles removal from one or both testes decrease the sperm concentration by 50% in comparison to a normal individual [28]. In the case of cystectomy or prostatectomy, it has been shown that patients may suffer from severe azoospermia and erectile dysfunction [29].

1.2. Fertility Preservation. Fertility preservation is usually defined as a process of preserving reproductive cells including oocytes, sperm, and embryos, or reproductive tissues including ovarian and testicular tissues to enable individuals to start a family at a time of their choice when their fertility is compromised [30]. The main objective of fertility preservation intervention is to minimize the primary disease burden and more importantly to ensure maintaining or preserving the reproductive health [31].

Oncofertility is a common term for fertility preservation in cancer patients. For individuals who are diagnosed with cancer, fertility preservation is a significant thought when there is a chance that cancer treatment may influence their

fertility. Fortunately, there are currently tremendous fertility preservation options that are accessible to cancer patients, and there are numerous individuals who have had the option to begin a family after cancer treatment [32].

With regard to fertility preservation in Saudi Arabia, the Islamic Fatwas were in good agreement with the Saudi System of Fertilization and Embryology Units. In 21-11-1424 H, the system declares that the intervention of third-party reproduction such as sperm, oocytes, and embryo donor/banking is prohibited by law and religion. In addition, it states that fertility preservation options such as embryo freezing can only be offered to married couples, and in case of divorce or death, the frozen embryos must be destroyed [33].

1.3. Fertility Preservation Options for Women

1.3.1. Cryopreservation. It is a process used to safely preserve human tissues using liquid nitrogen vapor at shallow temperatures at −196°C. Such a technique is important to stop cell degradation and aging by reversibly halting the metabolism. Furthermore, it maintains the tissue's structure and preserves the tissue's ability to develop and grow after freezing [34]. Cryopreservation has numerous methods, including slow freezing, conventional vitrification, and ultrarapid vitrification [35].

(a) Oocytes Cryopreservation

It is a common approach to preserving fertility for postpubertal single girls [36]. The ovaries are stimulated then; mature oocytes are extracted, frozen, and stored for future use. The frozen oocytes can be used in IVF/ICSI techniques [13].

(b) Ovarian Tissues Cryopreservation

A surgical procedure for prepubertal and postpubertal [27]. The ovarian tissue is extracted surgically, then fixed in a liquid preservative, cut into thin slices/pieces, and carefully soaked and stored for future use [28]. The ovarian tissue can be transplanted back into the body following cancer therapy to restore ovarian function [14].

(c) Embryo Cryopreservation

It is an option offered for women before undergoing cancer therapy. This procedure involves ovarian stimulation to produce multiple oocytes. Two to three weeks after, mature oocytes are retrieved, and in vitro fertilized. The resulted viable embryos are chosen to be frozen and then stored for future use [27].

1.4. Fertility Preservation Options for Men

1.4.1. Sperm Extraction. It is a method to preserve fertility in men and postpubertal boys with azoospermia [27]. This procedure is performed before starting cancer treatment with chemotherapy or radiotherapy [29]. It includes passing a tiny needle into the epididymis or the testes surgically to collect the sperm cells, which will be frozen by one of the cryopreservation methods [14]. Extracted sperm are stored for future use in the assisted reproduction technologies (ART) including In Vitro Fertilization (IVF), Intrauterine Insemination (IUI), and Intracytoplasmic Sperm Injection (ICSI) [29].

1.4.2. Radiation Shielding. A technique used for patients who are treated with radiotherapy, where special shields are placed over the testicles during radiation to reduce the negative effects of radiation. Nevertheless, it does not protect against chemotherapy or total body irradiation [14]. There are several types of shields, such as the calm lead shield [30].

1.4.3. Testicular Transposition. A surgical method is used for prepubertal boys to protect their fertility against radiation. During this procedure, the testis is transposed from the irradiation site, then wrapped in silicon, and placed in the abdomen's anterior wall before starting the therapy to minimize the radiation effects. Following cancer recovery, testis can be surgically transferred to its position and fertility is restored within a year to two years [30].

1.5. Aim of the Study.

The current study aims to evaluate the level of knowledge, attitude, and practice towards fertility preservation in cancer patients among health practitioners in an environmental region of Saudi Arabia.

2. Methods

This cross-sectional study was conducted to evaluate the level of knowledge about attitude and practice towards fertility preservation in cancer patients among health practitioners who work closely with cancer patients in the Makkah region. The study was conducted between September 2020 and January 2021. Ethical approval (AMSEC 27/1-3-2020) for the study was obtained from the Institutional Ethics Committee at Umm Al-Qura University. The instrument of the study was a self-administered closed-ended questionnaire with a brief introduction to explain the objectives of the survey. The study's questionnaires were randomly distributed to any health practitioners who work closely with cancer patients, and the study participants included 100 health practitioners from a variety of specialties such as medical and clinical oncologists, surgeons, hematologists, nurses, and laboratory specialists, anesthesiologists, pharmacists, and radiologists. In addition, the study participants were asked to sign the written informed consent form to maintain the privacy of their information and were informed that their participation is voluntary and that they can withdraw from the questionnaire at any time.

The current questionnaire was designed and developed by the authors of this study using the Google Forms tool. It was provided in the English language only. The link to the questionnaire was generated and sent as a WhatsApp message to the participated health practitioners' phone numbers or as a Twitter message on their personal Twitter

social media accounts. The questionnaire consisted of 18 closed-ended questions which were divided into four main sections. These include the knowledge, attitude, and practice of health practitioners towards fertility preservation among cancer patients, followed by a final section about socio-demographic information, such as participants' age, gender, and workplace. To validate the study questionnaire, a pilot study was performed to test the reliability and acceptability of the study and to confirm that the participants were able to understand each question in the same manner. In addition, to test the duration of time required to answer the questionnaire. For this, ten healthcare practitioners, who were experienced in treating cancer patients in Makkah region, were randomly selected and kindly asked to answer the same questionnaire. Their answers were then checked to detect if any variations might arise from the translation of the questions. According to the results of the pilot study, there were no modifications or omission of unnecessary or repeated questions. Health practitioners who participated in the pilot study were excluded from the study subjects.

2.1. Statistical Analysis. Data entry and statistical analysis were done using the Statistical Package for Social Sciences software version 20.0 (SPSS Inc. Chicago, Illinois, USA). Mean and standard deviation were used to describe numerical data, and the percentage was used for categorical data. Frequencies of correct knowledge answers and various attitudes and practices were described. The Chi-square (χ^2) test and Student's t-test were used for categorical data and continuous variables as appropriate. Results with a Pvalue of <0.05 were considered statistically significant.

3. Results

One hundred healthcare practitioners who work with cancer patients in Makkah region agreed to participate in this study. The participants' age ranged from 25 to 65 years. The targeted population included both male and female practitioners (51% and 49%), respectively. Most of the study participants (75%) are working in Jeddah city, while 24% and 1% are working in Makkah and Taif city, respectively (Table 1).

As shown in Table 1, the demographic findings show a variety of cancer subspecialties among the study respondents of which, 30% were sub-specialized in gynecological cancer, followed by 24% in hematological cancer and other specialties.

Figure 1 shows the distribution of health practitioners according to their specialties. It appears that nurses were the most participating group (23%), followed by gynecologists (18%), surgeons (9%), medical oncologists (8%), and hematologists (8%). The results also show that other minor specialties accounted for less than 7% of total respondents. For example, radiation oncologists, anesthesiologists, fertility specialists, laboratory technicians and specialists, ophthalmologists, dermatologists, IVF consultants, clinical pharmacists, medical consultants, preventive medicine specialists, critical care doctors, pharmacists, and gastrologists.

Figure 2 illustrates the knowledge level of health practitioners regarding fertility preservation of cancer patients. The study reveals that 90% of the respondents need to raise their knowledge about fertility preservation in comparison to 10% who declared that they are knowledgeable. In addition, 51% of the participated health practitioners confirmed that they might be aware of fertility preservation, but they need to be knowledgeable about it. In contrast, 35% of respondents declared that they are knowledgeable or had adequate knowledge regarding fertility preservation. Among hundred participants, 14% declared that they do not know about fertility preservation. There was no significant association between health practitioners' knowledge and gender, age, workplace, and cancer subspecialty (all Pvalues >0.05).

With regard to fertility preservation procedures and options, data presented in Figure 3 reflect that most of the study participants ($n = 87$) were familiar with sperm freezing. The second, most commonly known option by health practitioners was egg freezing ($n = 72$). On the other hand, embryo, ovarian, or testicular tissue freezing, and GnRH-agonists pretreatment were the least fertility preservation options known to study respondents, ($n = 39$, 38, and 26, respectively).

Figure 4 displays the participants' attitudes regarding the most concerned gender about fertility preservation. Most health practitioners ($n = 59$) reported that both male and female populations considered fertility preservation options before cancer treatment. Among hundred participants, 26 health practitioners would consider women patients for fertility preservation, compared to 15 respondents who considered men patients to be the most concerned.

With regard to health practitioners' attitude in fertility preservation discussion, as demonstrated in Table 2 it appears that 66% of them agreed that fertility preservation was a high priority to be discussed with newly diagnosed cancer patients. In addition, 58% of study participants declared that they feel comfortable discussing fertility preservation with their patients. In contrast, few respondents disagreed with both statements (15% and 21%), respectively.

The study survey also included some questions about the success rates of fertility preservation and whether treating primary cancer is more important than fertility preservation. Around 54% of health practitioners agreed that treating cancer had a higher priority than fertility preservation. On the other hand, 21% disagreed with this statement. Nonetheless, the percentages of agreeing (36%) and disagreeing (41%) participants with the statement that fertility preservation is not a viable procedure for cancer patients due to its low success rates were nearly similar (Table 2).

The factors that influenced health practitioners' attitudes towards fertility preservation discussion with cancer patients are summarized in Table 3. It appears that more than 90% of health practitioners would discuss fertility preservation unless their cancer patient has a poor prognosis and/or cannot afford the expenses of fertility preservation. Other health practitioners declared further reasons that could affect their decision in discussing fertility preservation with

Table 1: Distribution of study participants according to their demographic characteristics.

Characteristics	Participants number	
	No.	%
Gender		
Female	49	49
Male	51	51
Age		
25–35	38	38
36–45	31	31
46–55	15	15
Over 55	16	16
Workplace		
Makkah	24	24
Jeddah	75	75
Taif	1	1
Cancer subspecialty		
Gynecological	30	30
Hematological	24	24
Breast	16	16
Pediatric	13	13
Lung	4	4
CNS	3	3
Urological	3	3
Gastrointestinal	3	3
Sarcomas/soft tissue	3	3
Head and neck	1	1

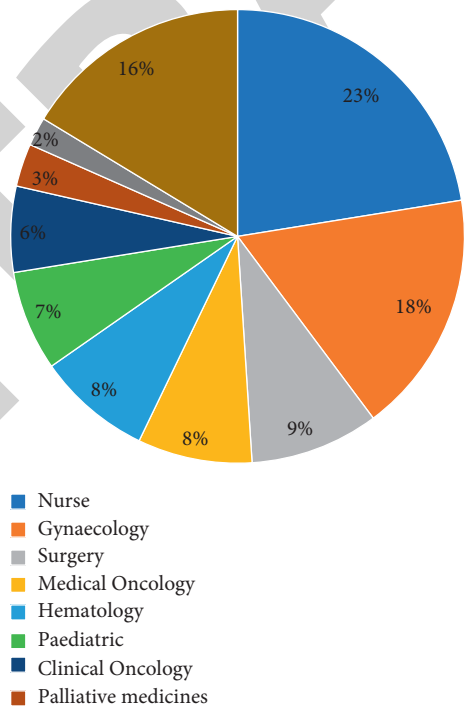

Figure 1: Health practitioners' distribution according to their specialties. The pie chart shows that Nurses' health practitioners were the most participating health practitioners in this cross-sectional survey, followed by health practitioners who work as gynecologists, surgeons, medical oncologists, and hematologists.

their patients such as lack of fertility services in the patients' area (85%), the patient being too ill to delay treatment to pursue fertility preservation (85%), the patient is being diagnosed with hormonal sensitive malignancy (84%), or the patient already had a child or children (78%). On the other hand, the factors related to patients such as the inability to afford fertility preservation procedures or poor prognosis were among the least chosen reasons by study respondents

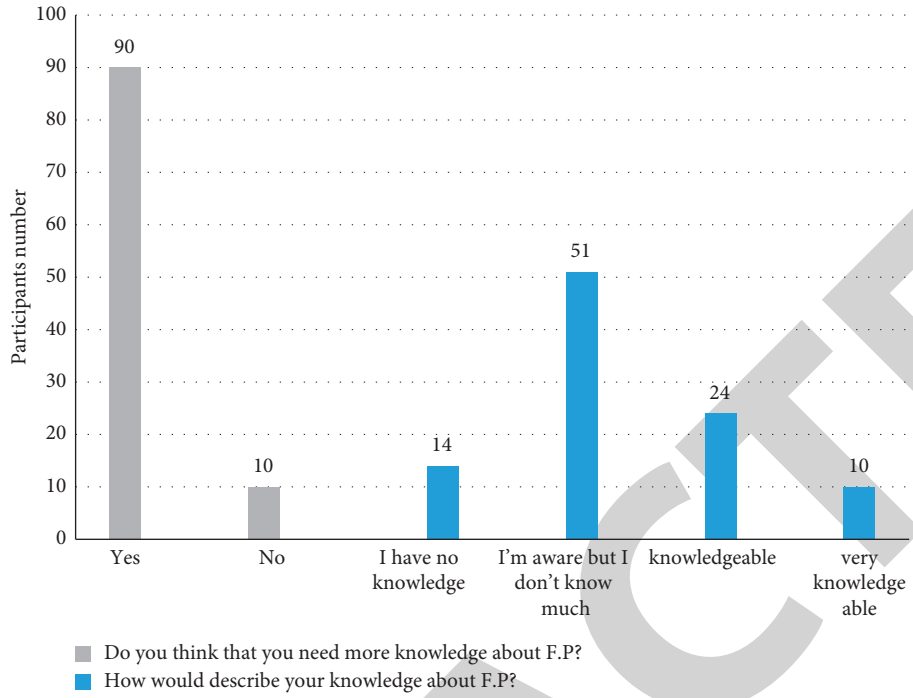

Figure 2: Health practitioners' distribution according to their knowledge about fertility preservation. The bar chart shows that 90% need to raise their knowledge about fertility preservation, and 51% are aware of fertility preservation but they need to be knowledgeable about it.

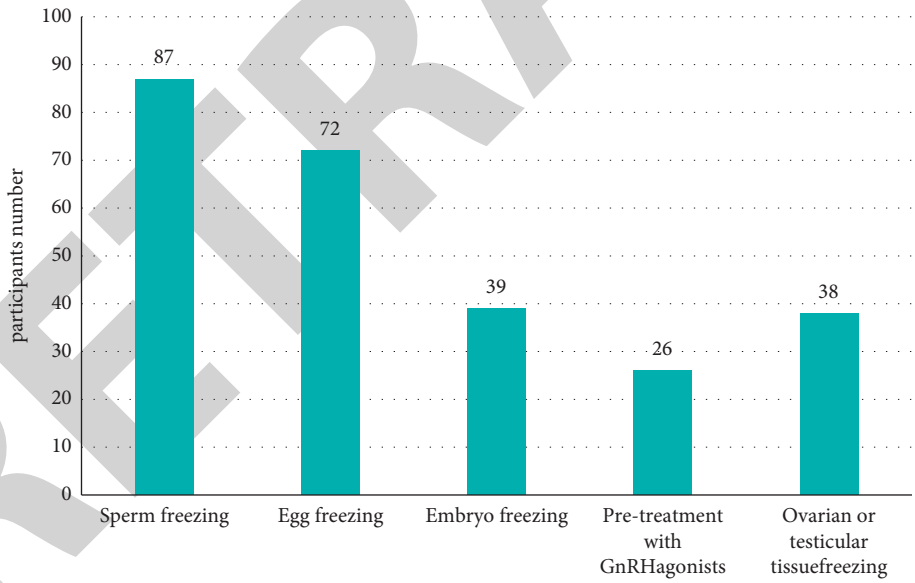

Figure 3: Health practitioners' distribution according to their knowledge about fertility preservation available options. The bar chart shows that 87% of study participants were familiar with sperm freezing. The second, most commonly known option by health practitioners was egg freezing. On the other hand, embryo, ovarian, or testicular tissue freezing, and GnRH-agonists pretreatment were the least fertility preservation options known to study respondents.

that may affect their potential discussion with cancer patients (Table 3). There were significant associations between health practitioners' attitudes in discussing fertility preservation with their cancer patients and the influenced discussion factors (all Pvalues <0.05).

Figure 5 displays participants' attitudes towards fertility preservation practice guidelines. It appeared that among one hundred participants, 97% agreed with the need for fertility preservation practice guidelines ($P < 0.001$) compared to only 3% of participants who disagreed with the importance of creating fertility preservation practice guidelines (Figure 5).

Regarding fertility preservation referral, as illustrated in Figure 6 it appears that the majority of health practitioners

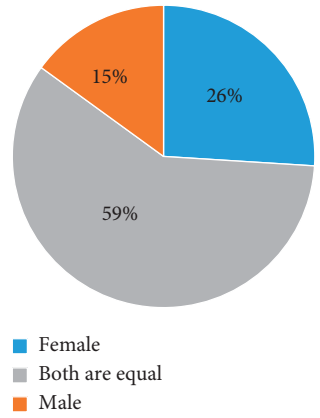

Figure 4: Health practitioners' attitudes regarding patients most concerned gender about fertility preservation. The pie chart shows that 59% of study respondents reported that both males and females are equally concerned about fertility preservation options before cancer treatment, while 26% and 15% of study participants would consider women and men patients, respectively, for fertility preservation.

Table 2: Health practitioners' attitude in discussing fertility preservation with their cancer patients.

Health practitioners' attitude	Agreement no. (%)	Neither no. (%)	Disagreement no. (%)
Fertility preservation is a high priority for me to discuss with newly diagnosed cancer patients	66 (66%) ($P < 0.05$)	19 (19%)	15 (15%)
I feel comfortable discussing fertility preservation with my patients	58 (58%) ($P < 0.05$)	21 (21%)	21 (21%)
Treating the primary cancer is more important than fertility preservation	54 (54%) ($P < 0.05$)	25 (25%)	21 (21%)
The success rates of fertility preservation are not as yet good enough to make it a viable option	35 (36%)	24 (24%)	41 (41%)

Table 3: Factors influence health practitioner's discussion of fertility preservation with their cancer patients.

Factors	Agreement No. (%)	Disagreement No. (%)
The patient cannot afford fertility preservation	92 (92%) ($P < 0.001$)	8 (8%)
The patient has a poor prognosis	91 (91%) ($P < 0.001$)	9 (9%)
Lack of fertility services in the area	85 (85%) ($P < 0.001$)	15 (15%)
The patient is too ill to delay treatment to pursue fertility preservation	85 (85%) ($P < 0.001$)	15 (15%)
The patient has a hormonally sensitive malignancy	84 (84%) ($P < 0.001$)	16 (16%)
The patient already has a child or children	78 (78%) ($P < 0.001$)	22 (22%)
The patient does not want to discuss fertility preservation	77 (77%) ($P < 0.001$)	23 (23%)
Constraints on my time	72 (72%) ($P < 0.001$)	28 (28%)
Someone else within my practice discusses fertility preservation with my patients	70 (70%) ($P < 0.001$)	30 (30%)
My limited knowledge of fertility preservation options	69 (69%) ($P < 0.001$)	31 (31%)
The patient is single	57 (57%) ($P < 0.001$)	43 (43%)

($n = 69$) ($P < 0.01$) are aware of a special clinic for fertility preservation or a specialist who will accept their referral compared to 31 individuals, who agreed that they are not aware of a particular clinic nor a specialist. Even though most of the respondents were aware, 46 did not refer any patient to fertility preservation ($P < 0.05$). On the other side, about 22 health practitioners declared that they referred up to 5 patients to fertility preservation. Furthermore, 32 confirmed that they referred more than five patients in the last five years (Figure 6). Independent sample t-tests and $\chi 2$-tests were also used to detect the association between participants' attitudes towards fertility preservation practice guidelines and their referral practice. There were significant relationships (all Pvalues <0.05).

With regard to the most important factor for referring patients to fertility preservation, it appeared that many health practitioners ($n = 25$) consider the type of cancer, and ($n = 22$) select patient prognosis as the second most factor affecting their decision in referring the cancer patients. The cost and the patient's desire were among the most important factors for cancer patient referral, ($n = 20$ and 18), respectively. The bar chart also showed other less important factors

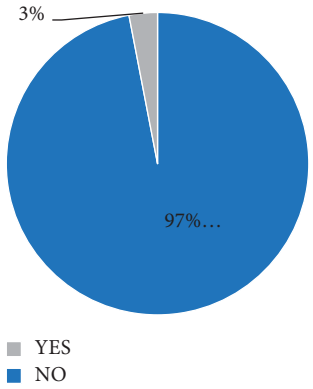

Figure 5: Health practitioners' attitude towards fertility preservation practice guidelines. The pie chart showed that 97% ($P < 0.001$) of the participants agreed with the need for fertility preservation practice guidelines compared to only 3% of participants who disagreed with the importance of fertility preservation practice guidelines.

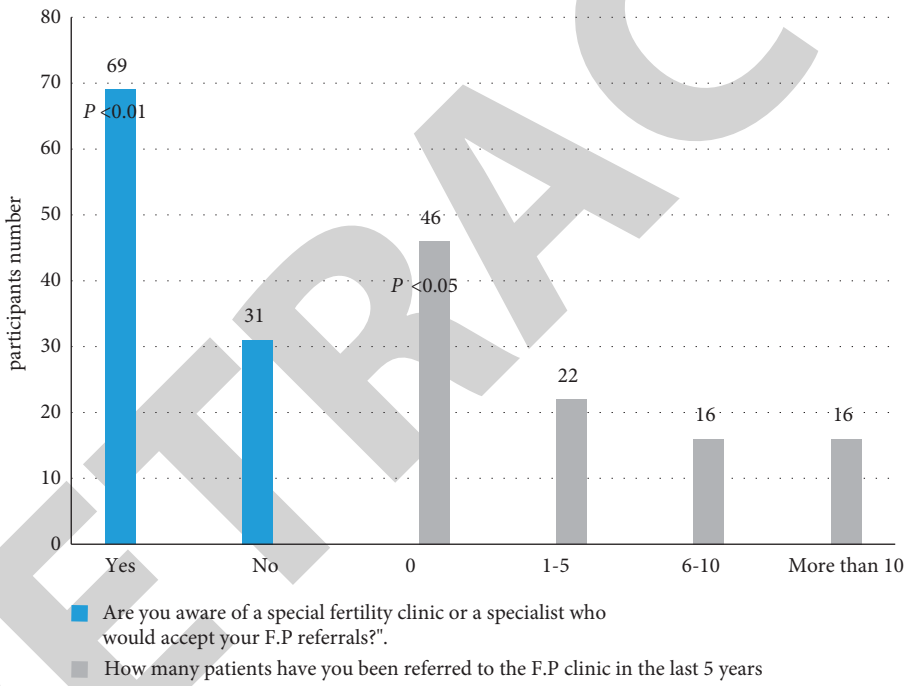

Figure 6: Health practitioners' distribution according to their practice towards fertility preservation among cancer patients. The bar chart shows that 69% of participants are aware of a special clinic for fertility preservation or a specialist who will accept their referral ($P < 0.01$). *E*ven though most of the respondents were aware, 46% did not refer any patient to fertility preservation during his/her last five years ($P < 0.05$).

such as the logistic issues, gender, time, and patient's marital status (Figure 7).

In terms of participants' desire to have a free fertility preservation service for cancer patients provided by the Saudi Ministry of Health, it showed that most of the study participants (92%) agreed with the statement compared to 8% who disagreed with this notion (Figure 8).

4. Discussion

This study was conducted to assess the level of knowledge, attitude, and practice of health practitioners towards fertility preservation in cancer patients in Makkah region. The study indicates several significant findings. Firstly, the insufficient knowledge of health practitioners regarding fertility preservation could be mainly due to the lack of fertility preservation topics in medical education. Moreover, the national and private health care system in Saudi Arabia has focused only limited attention on fertility preservation. This highlighted the need to increase the knowledge regarding fertility preservation. The current finding was similar to the previous studies, which reported a lack of fertility preservation knowledge among health practitioners in France and Hong Kong.

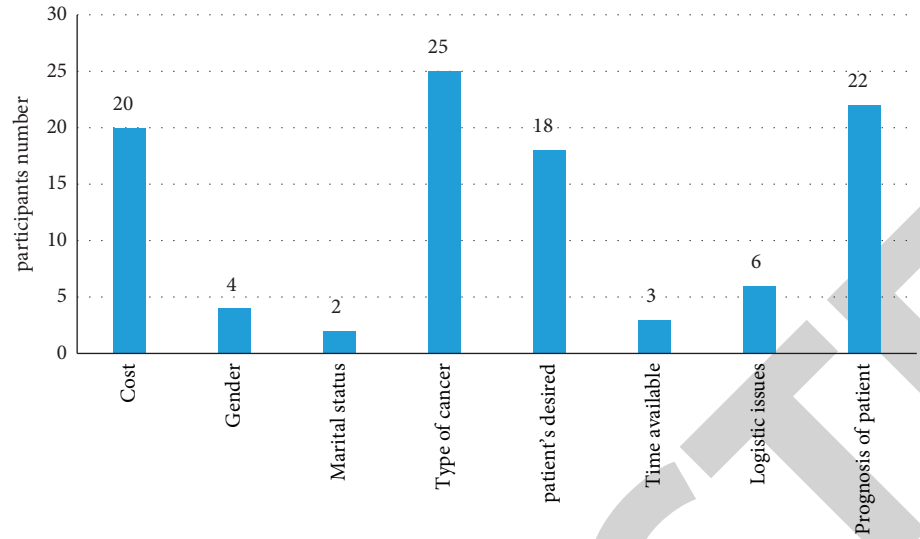

FIGURE 7: The most important factors in terms of patients' referrals according to the study participants. The bar chart shows that 25% and 22% considered the type of cancer and patient prognosis as the first and second most factors affecting their decision in referring the cancer patients, respectively. The cost and the patient's desire were also among the most important factors for a cancer patient's referral, while the logistic issues, gender, time, and patient's marital status were less important factors.

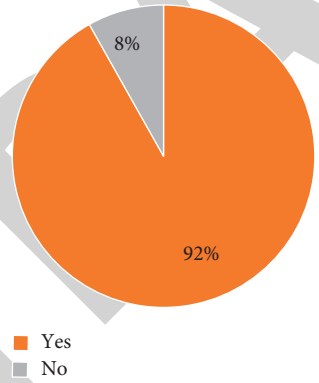

FIGURE 8: Health practitioners' opinions regarding fertility preservation service. It showed that 92% of the study participants agreed with the statement, compared to 8% who disagreed with this notion.

Secondly, fertility preservation options such as sperm and oocyte cryopreservation appeared to be the most commonly known procedures among health practitioners. This is because these two options are the most recommended options by ASCO and the mostly used by doctors worldwide. For males, sperm cryopreservation is an effective and simple technique, which requires the production of a semen sample at any time before commencing the cancer treatment [7, 8]. However, in the female population, fertility preservation is more complex, costly, and time-consuming than in men. Oocyte or embryo freezing was more popular than ovarian tissue freezing among health practitioners. These findings were consistent with a previous study in Hong Kong, which found that the majority of health practitioners were familiar with sperm and oocyte freezing [8].

Thirdly, the current study showed that both females and males would be considered for fertility preservation. This highlights the fact that both genders are interested in reproduction and childbearing. This finding was in contrast to a previous study by Tschudin and Bitzer (2009), who reported that women were more interested in fertility preservation than men [31, 32].

Fourthly, most participating health practitioners declared that they are very likely to discuss fertility preservation with their cancer patients. However, many factors may significantly affect their attitude towards fertility preservation discussion such as poor patient prognosis or that the patient cannot afford the expenses of fertility preservation. These findings were in agreement with previous studies, which reported that the poor patient prognosis and the cost were among the factors that affected the health practitioners' attitudes to discuss fertility preservation with cancer patients [7, 8]. Moreover, the current study illustrates a low referring rate to fertility preservation. The reasons behind this could be related to the cancer type, patient prognosis, the cost, and the lack of fertility preservation

centers in the patient area. Similar findings were also reported in a previous study conducted in Lebanon, where the clinicians had no choice but to not refer patients for fertility preservation due to the absence of well-developed fertility preservation centers [9].

Furthermore, the majority of study participants agreed that fertility preservation and referring patients to such services should be associated with clear practice guidelines. This attitude can be explained by the lack of fertility preservation topics in general medical education and thus the need to increase the professional practical knowledge of fertility preservation. This result was consistent with a previous study in Hong Kong, which demonstrated a positive attitude and a great desire of health practitioners to establish fertility preservation practice guidelines [8].

In addition, most health practitioners in Makkah region agreed on the need for public fertility preservation services for cancer patients provided by the Saudi Ministry of Health. The cost of fertility preservation for a cancer patient plays an important role in the health practitioner's decision to discuss and refer the patient. In Saudi Arabia, the cryopreservation of sperms, oocytes, embryos, and other fertility preservation options are only available at private hospitals and a limited number of patients can afford it. Therefore, the Saudi Ministry of Health should consider providing these services to public or selected cancer patients. Clinicians in Hong Kong also agreed that patients have difficulties in paying for fertility preservation and suggested providing free clinics or centers for fertility preservation [8].

5. Conclusions

To our knowledge, this is the first study that assesses the knowledge, attitudes, and awareness of healthcare practitioners towards fertility preservation in cancer patients in Saudi Arabia, particularly in the Makkah region. As a result, healthcare practitioners' knowledge remains insufficient. Hence, further efforts are required to be conducted to ensure that the practitioners are discussing fertility preservation, its available options, and patients' referral to fertility preservation clinics before cancer treatments. This includes education, training programs, and increasing awareness campaigns regarding fertility preservation. Additionally, the establishment of well-developed fertility preservation services, referrals centers, and practice guidelines are recommended. Moreover, fertility preservation services should be provided as a free service to patients suffering from cancer. Such services should be funded by the Saudi Ministry of Health. Further studies in terms of cancer treatments risks and fertility preservation rights in Saudi Arabia are recommended [33].

Abbreviations

ASCO: American society of clinical oncology
ART: Assisted reproduction technologies
°C: Celsius
CNS: Central nervous systems
DNA: Deoxyribonucleic acid
F.P: Fertility preservation
GCO: Global cancer observatory
GnRH: Gonadotropin-releasing hormone
IVF: In vitro fertilization
ICSI: Intracytoplasmic sperm injection
IUI: Intrauterine insemination
MOH: Ministry of health
NHL: Non-hodgkin lymphoma
WHO: World health organization.

Data Availability

The datasets used and/or analyzed during the current study are available from the corresponding author upon reasonable request.

Ethical Approval

Study ethical approval No. AMSEC 27/1-3-2020 was obtained from the Scientific Research Ethics Committee at Umm Al-Qura University in Makkah, Saudi Arabia. Each study's participants were asked to sign the written informed consent form to maintain the privacy of their information and were informed that their participation is voluntary and that they can withdraw from the questionnaire at any time.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

Authors' Contributions

RAS was a major contributor to writing the manuscript, analyzing the data, and studying the design. MSB contributed in writing the manuscript. LMA analyzed and interpreted the participant's data. RZA analyzed and interpreted the participant's data. RYR developed the study questionnaire and distributed it. SMA developed the study questionnaire and distributed it. All authors read and approved the final manuscript.

References

[1] GOC, "The global cancer observatory," 2020, https://gco.iarc.fr/today/data/factsheets/cancers/39-All-cancers-fact-sheet.pdf.
[2] GCO, "The global cancer observatory," 2020, https://gco.iarc.fr/today/data/factsheets/populations/682-saudi-arabia-fact-sheets.pdf.
[3] B. Simon, S. J. Lee, A. H. Partridge, and C. D. Runowicz, "Preserving fertility after cancer," *CA: A Cancer Journal for Clinicians*, vol. 55, no. 4, pp. 211–228, 2005.
[4] World Health Organisation(WHO), 2022, https://www.who.int/news-room/fact-sheets/detail/infertility.
[5] S. Amoudi, "Reproductive health rights for cancer patients," in *Jurisprudence Rulings and Legal Controls for Sterility and Fertilization, and Modern Reproductive Techniques: Health Empowerment and Health Rights Unit Faculty of Medicine*, King Abdulaziz University, Makkah, Saudi Arabia, 1st edition, 2017.

Hindawi
Journal of Environmental and Public Health
Volume 2023, Article ID 9763039, 1 page
https://doi.org/10.1155/2023/9763039

Retraction

Retracted: Hyperspectral Image Analysis of Colon Tissue and Deep Learning for Characterization of Health care

Journal of Environmental and Public Health

Received 26 September 2023; Accepted 26 September 2023; Published 27 September 2023

This article has been retracted by Hindawi following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of one or more of the following indicators of systematic manipulation of the publication process:

(1) Discrepancies in scope

(2) Discrepancies in the description of the research reported

(3) Discrepancies between the availability of data and the research described

(4) Inappropriate citations

(5) Incoherent, meaningless and/or irrelevant content included in the article

(6) Peer-review manipulation

The presence of these indicators undermines our confidence in the integrity of the article's content and we cannot, therefore, vouch for its reliability. Please note that this notice is intended solely to alert readers that the content of this article is unreliable. We have not investigated whether authors were aware of or involved in the systematic manipulation of the publication process.

Wiley and Hindawi regrets that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our own Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

References

[1] A. Akram Abdulrazzaq, S. Sulaiman Hamid, A. T. Al-Douri, A. A. Hamad Mohamad, D. Selvi, and A. Mohamed Ibrahim, "Hyperspectral Image Analysis of Colon Tissue and Deep Learning for Characterization of Health care," *Journal of Environmental and Public Health*, vol. 2022, Article ID 8670534, 11 pages, 2022.

Hindawi
Journal of Environmental and Public Health
Volume 2022, Article ID 8670534, 11 pages
https://doi.org/10.1155/2022/8670534

Research Article

Hyperspectral Image Analysis of Colon Tissue and Deep Learning for Characterization of Health care

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Received 21 April 2022; Revised 3 May 2022; Accepted 16 May 2022; Published 31 May 2022

Academic Editor: Sivakumar Pandian

Colon cancer is a disease characterized by the unusual and uncontrolled development of cells that are found in the large intestine. If the tumour extends to the lower part of the colon (rectum), the cancer may be colorectal. Medical imaging is the denomination of methods used to create visual representations of the human body for clinical analysis, such as diagnosing, monitoring, and treating medical conditions. In this research, a computational proposal is presented to aid the diagnosis of colon cancer, which consists of using hyperspectral images obtained from slides with biopsy samples of colon tissue in paraffin, characterizing pixels so that, afterwards, imaging techniques can be applied. Using computer graphics augmenting conventional histological deep learning architecture, it can classify pixels in hyperspectral images as cancerous, inflammatory, or healthy. It is possible to find connections between histochemical characteristics and the absorbance of tissue under various conditions using infrared photons at various frequencies in hyperspectral imaging (HSI). Deep learning techniques were used to construct and implement a predictor to detect anomalies, as well as to develop a computer interface to assist pathologists in the diagnosis of colon cancer. An infrared absorbance spectrum of each of the pixels used in the developed classifier resulted in an accuracy level of 94% for these three classes.

1. Introduction

Colon cancer is a condition characterized by the abnormal and uncontrolled growth of cells that are present in the large intestine, which is the source of the disease. If the tumour has spread to the lower region of the colon (rectum), it is possible that the cancer is colorectal in nature [1]. Colon cancer is a disease characterized by the unusual and uncontrolled development of cells that are found in the large intestine. If the tumour extends to the lower part of the colon (rectum), the cancer may be colorectal [1]. Adenomatous polyps, which grow on the intestine's inner walls and are usually benign, are the origin of the majority of colon cancers. Hematoxylin and eosin (H&E) staining is used in the majority of colon cancer examinations, as is the case with most cancer diagnoses [2].

Machine learning is a branch of computer science that has been extensively used in pre-diagnosis research [3]. The development of algorithms that can learn from their mistakes and predict future events is quite appealing. Rather than just following preprogrammed instructions, these algorithms build a model from input samples to make predictions or judgments. Machine learning has many subareas, such as artificial neural networks (ANNs), convolutional

neural networks (CNNs), and ANN with deep learning architecture (or deep neural networks) [4]. The first is a set of computational models inspired by the nervous system that can learn and recognize patterns [5].

Many approaches have been developed to analyse HSI. Despite this variability, the use of HSI spatial information for tumour categorization is limited. Manni et al. [6] reviewed HSI analysis methods based on their classification approach. They are (a) preprocessing methods and (b) deep learning approaches (deep learning, DL). Methods for HSI analysis based on preprocessing procedures were adapted from traditional data analysis techniques. Initially, data modification and spectral band selection were utilized to solve HSI's high dimensionality. In this context, PCA and PLS approaches are commonly employed to extract spectral features [7] and support vector machines (SVMs) for spectral classification [8]. Later, recognizing the importance of spatial information in HSI classification, new spectra-spatial approaches were suggested, incorporating the dimensions x, y, and z. Spatial-spectral classification approaches improve spectral classification performance [9]. The wavelet transform (WT) has been widely employed in examining nonlinear features and kernel-based approaches (KM), such as kernel PCA and discriminant analysis in the Fisher core [10]. Manual approaches for HSI classification are still widely utilized in tumour diagnosis [11].

Deep learning has recently enhanced HSI categorization [12]. Tasnim et al. [13] created a five-layer CNN with basic CNN elements in the input layer. L'Heureux et al. [14] used HSI to diagnose thyroid cancer, while Dariya et al. [15] used HSI to diagnose colon cancer. It was trained on 50 patient samples of excised squamous cell carcinoma, thyroid cancer, and normal head and neck tissue. This work investigates the use of hyperspectral infrared images for pattern recognition and tissue anomaly identification. Each pixel requires a spectrum of hundreds or thousands of different frequencies. ANNs with deep learning architecture are efficient and effective ways to manage enormous datasets. An application can learn about a hyperspectral image's attributes and differences from previous classification records used to train a classifier. The use of ANN algorithms with deep learning architecture was chosen since they have been used widely and have produced some of the greatest results [16]. ANN with deep learning architecture thus stands out among the most widely used artificial intelligence methodologies because of its robustness and result quality. ANN with deep learning architecture seems promising for this purpose. The use of infrared spectra to identify aberrant colon tissue sections in biopsy samples will be explored, implemented, and assessed. The idea was to test whether hyperspectral images might identify aberrant tissue patches.

Spatial and Brightness Discrete Image (x,y). Assume that each row and column represents a single picture point. While the pixel is the smallest visual unit in two dimensions (x and y), it is closely followed by the voxel (x, y, and z). Each pixel in a digital image has spatial coordinates and numerical values. Each pixel in a grayscale image creates a two-dimensional data matrix. Images in red, green, and blue (RGB) (Figure 1) are constructed as a three-dimensional data matrix.

A spectral image is one that reproduces an object based on its wavelength. This type of imaging provides geographical and chemical information about the sample. Imaging uses a digital camera to capture spatial data, while spectroscopy uses a spectrometer to capture spectrum data. However, before editing hyperspectral images, they must be transformed into a data matrix. In a two-dimensional matrix, each pixel is a sample of intensity values (or frequencies), which are organized in lines according to the given order. Applications such as MATLAB make this possible. Basic and quick image segmentation algorithm is developed for the detection of inflammatory and malignant tumours in colon biopsy samples using infrared spectra. It is recommended for instances where identifying and extracting an object from a picture take a long time. This last phase used analytical cross-validation because the original experiment used a lot more data I achieved the following: similarity, segmentation, and edge detection and this is sufficient to prove the validity of the analysis.

Otsu Method: the Otsu approach maximizes the variance between picture classes, or the separation between object and image backdrop. Otsu is an object-oriented method. Otsu is a great solution for general real-time computer vision applications. Its sequential implementation sets a global threshold. The idea is to cycle through all possible edge values in an image, aiming for the one that minimizes the image's intraclass variance. This value separates foreground and background and assigns a color to each class. Equation (1) calculates the intraclass variance for a possible threshold t.

$$\sigma_w^2 = w_b\sigma_b^2 + w_f\sigma_f^2, \tag{1}$$

where w is the weight for each class. This measure corresponds to the probability that a pixel has to belong to class b (background) or f (foreground).

2. Methodology

Current histological colon biopsy evaluations include tissue collection, colonoscopy, and pathologist analysis of the H&E picture. The time to diagnose depends on both the quality of the material and the professional's skill. Several studies propose optimizing this process in histological tests using technologies such as hyperspectral imaging and ANNs. There was no research on using hyperspectral imaging with RNA technology and deep learning architecture to characterize colon tissues in three classifications (cancer, inflamed, and healthy).

Hyperspectral imaging was thought to identify anomalies embedded in its pixels' spectrum and give the assisting in the diagnosis of colon cancer utilizing RNAs with deep learning architecture to assess pixels in hyperspectral pictures generated from slides with biopsy samples of colon tissue in paraffin but now was to identify inflammatory and malignant tumors in colon biopsy samples using infrared spectra. The application's goal is to supplement conventional histological examinations with a pre-diagnosis computer visual tool that helps develop more trustworthy and accurate diagnoses. The proposal also claims that hyperspectral scans may distinguish cancerous, inflammatory, and healthy tissue

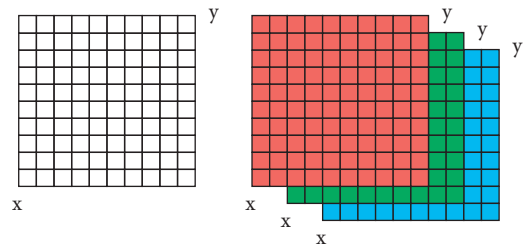


Figure 1: Image data matrix: (a) in gray scales and (b) in RGB.

regions based on their pixel spectrum. Proposing the method proof requires various stages in the produced modules. Thus, the system used in the proposed experiment is composed of five modules, as follows:

(a) ROI Database Generator—system that automatically assembles the database that was used in the classifier training module, containing only the digital ROIs (and their respective 1626 hyperspectral frequencies) previously defined manually by the pathologist. The system automatically generates—in a single file—all ROIs from a database of hyperspectral images categorized in the CIS classification.

(b) Optimization and Cross-Validation—manually defining the best hyperparameters for an ANN with a deep learning architecture can be an expensive job. In order for the classifier training module to be executed more precisely, in this second step, it was proposed to implement a system that automatically selects the best hyperparameters from a native Keras resource: the best_params attribute of the GridSearchCV function. Once the best hyperparameters are defined, it is extremely important to validate the ANN with a deep learning architecture using different fractions of the ROI bank through an authenticator system that uses the cross-validation methodology [17].

(c) Classifier Training—after all the steps for generating the ROI bank and optimizing and validating the best RNA hyperparameters with a deep learning architecture, this implementation generates the file containing the weights and the final training that will be used in the production tooling.

(d) Production Tooling—the implementation allows loading a hyperspectral image of colon cancer biopsy at the input, enabling the classification of each of its pixels according to the CIS classification trained in the classify training module, generating a new digital image at the output colorized containing the pre-diagnosis result.

(e) Web Interface PAIH–friendly Web interface, easy to distribute, and that allows the pathologist and researchers to select and pre-diagnose hyperspectral images in a visual, quick, and simple way.

Figure 2 shows the operating process of the proposed application and the dependency between the developed modules, where

(a) It is the hyperspectral image file in its standard format (FSM)

(b) The file is then opened in the MATLAB application for metadata analysis

(c) The FSM file is converted and exported to CSV format

(d) Base (directory) of hyperspectral data in CSV format

(e) ROI bank generator module

(f) ROI bank, also in CSV format

(g) Classifier training module

(h) JSON file containing the structure of the ANN

(i) Production tooling module

(j) Application Web interfaces

(k) Visual pre-diagnosis result

(l) Parts that constitute the PAIH Web interface

2.1. Test Environment. To minimize the time of the experimentation phase of this research, two different test environments were used. The first is a conventional computer, intended for lighter processing tasks, such as the ROI bank generator, the production tooling, and the PAIH Web interface [16]. The second is a dedicated server, used in tasks that required more time and processing consumption, such as optimization and cross-validation and classifier training. The dedicated server belongs to the department of computing and mathematics (DCM) in our university. In both test environments, the same programs and libraries were installed, allowing all developed modules to be executed correctly in any environment. The algorithms of all modules were written using the Python programming language in its version 3.7.0. The Google TensorFlow 2.0 Machine Learning Library and the Keras 2.4 RNA API complete the basic test environment requirements for this research. Other supplementary technologies complemented the structure of the developed modules and will be specified in their respective subsections.

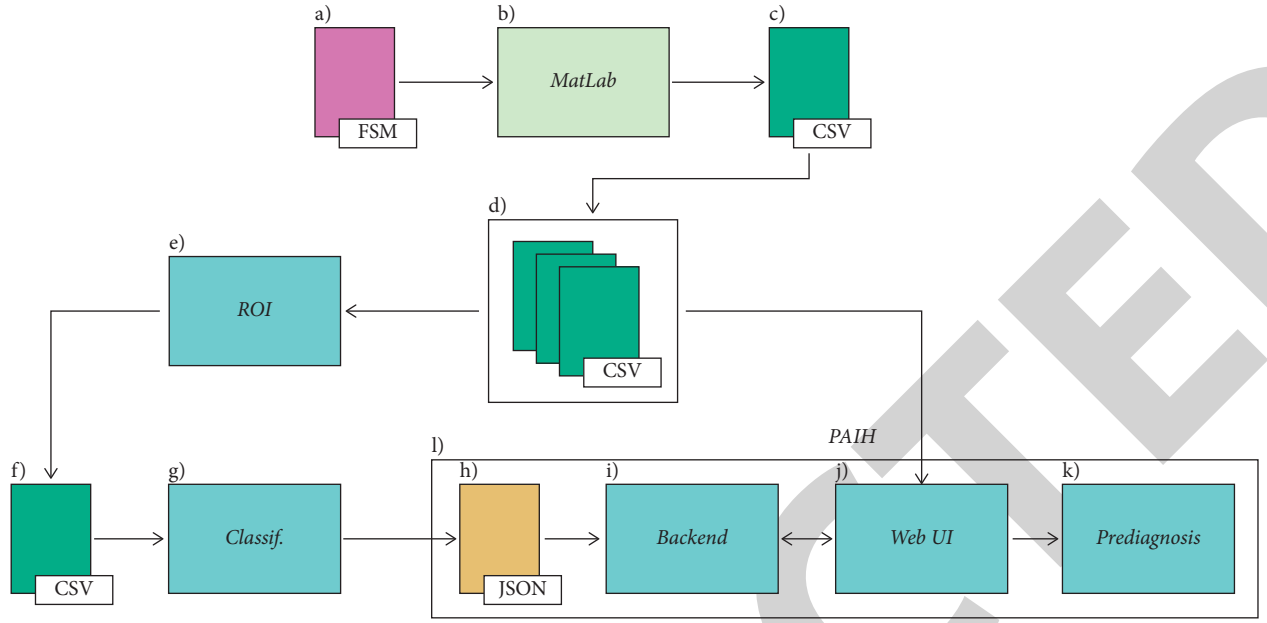


Figure 2: Scheme of functioning and dependence of the processes developed in the research.

2.1.1. Image Base. Both hyperspectral pictures of colon tissue and digital photographs stained with H&E were employed in this study. The pictures were taken from the open-source library. First, the photographs were created in FSM format and divided into three groups: 9 photographs identified as malignant, 9 as inflamed, and 9 as healthy. The input of the deep learning ANN classifier in matrix format is as follows: pixels in rows and frequencies in columns of the entity forming a hyperspectral image. The H&E digital images (Figure 3) help identify each hyperspectral image. The pathologist used the H&E pictures to label the pixels and mark the ROIs. Finally, the PAIH Web interface used these photographs to identify tests. This work's main output is hyperspectral image files. So, the first stage of the investigation was to learn how to read and alter these files. The images were created by an extractor utilizing MATLAB to extract data per pixel from these photographs. Because this is an unusual file type, the first step was to convert it to CSV. Results and discussions will explain why this conversion occurred [13].

2.2. ROI Bank Generator. When opening a hyperspectral image in FSM format in the MATLAB application, the system presents some entities that have, in addition to information about the pixels of the hyperspectral image, other important information about the file, such as the number of existing frequencies. This stage of the work aimed to understand the composition of these entities.

The main entities allocated in the metadata of a hyperspectral image are as follows:

(i) wn—the frequencies (total of 1626) referring to the wave number range (750–4000 cm^{-1}).

(ii) dy—the vertical pixel resolution of the hyperspectral image. In the example of Figure 4, 241 pixels are shown.

(iii) dx—the horizontal pixel resolution of the hyperspectral image. In the example of Figure 4, 193 pixels are shown.

(iv) R—the matrix containing the number of image pixels (dy multiplied by dx) by the number of frequencies.

The main entity, *R*, effectively retains the hyperspectral image's pixels and their 1626 frequencies. This entity's structure can be seen in MATLAB. The value corresponding to the matrix column in the *r* entity in the wn entity is checked to find the pixel absorbance value at the frequency corresponding to the wave number (1 to 1626). Other methods include converting numbers to cm1 using the equation: 750 + (2 * matrix column r) - 2, where the result is $750 + 2 * 1026 = 2800\ cm^{1}$. According to Silva (2013), to view an image in one of the 1626 accessible frequencies, a column (frequency) must be converted to a new data matrix with width and height equal to the metadata's dy and dx entities. An algorithm in the ROI bank generator application does this automatically, but it can also be done with MATLAB's imshow ($m(x,y,z)$) function, where imshow displays 2D images, m is a hyperspectral image matrix, x is the number of horizontal pixels to display, y is the number of vertical pixels to display, and z is the hyperspectral frequency of the z-axis. Figure 5 simulates the conversion.

The pathologist can then manually demarcate the detected locations with signs of malignancy, inflammation, or healthy tissue. The pathologist's free manual demarcations (Figure 5(c)) do not have the same number of pixels. So, beginning from the middle region of each manual demarcation, an uniform digital size of 50×50 pixels was created for all ROIs (Figure 5(d)), visually guaranteeing that each ROI, afterwards delimited in the hyperspectral picture, was placed within the pathologist's H&E image. As a result, all 27 ROIs have the same pixel resolution.

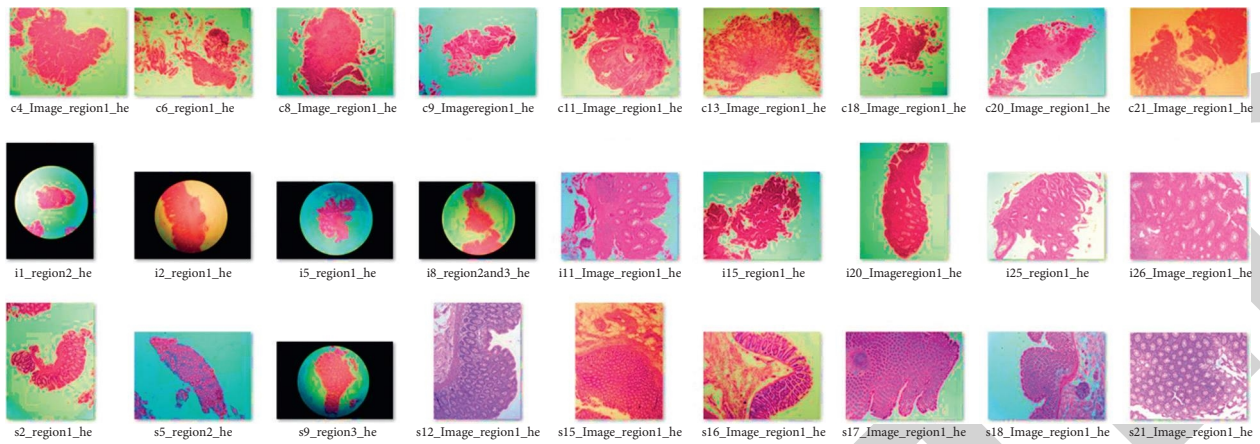


Figure 3: Set of 27 H&E images used to identify hyperspectral images in the image base and to demarcate ROIs by the pathologist.

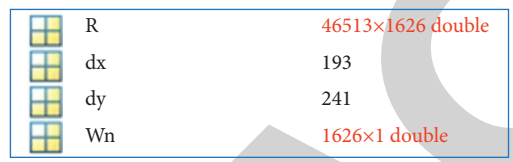


Figure 4: Composition of the main entities that are part of the structure of a hyperspectral image file in FSM format.

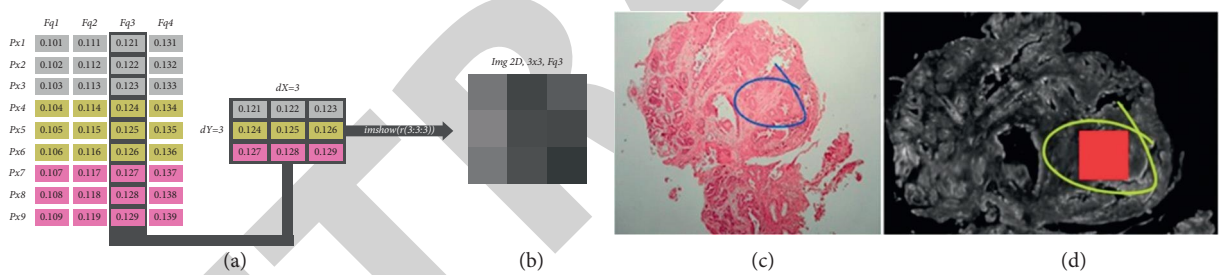


Figure 5: Simulation of how the rearrangement of a hyperspectral frequency is performed to generate a 2D image: (a) FSM hyperspectral image; (b) matrix rearranged according to dx and dy resolutions and (c) converted 2D image; (c) simulation of the demarcation performed manually by the pathologist in the H&E image; and (d) ROI (red square) digitally defined from manual demarcation, with a dimension of 50×50 pixels in the hyperspectral image.

In generating the ROI base, used to train the ANN classifier with deep learning architecture, it was necessary to group the resolution information and coordinates of all 27 ROIs—specified with 50×50 pixels—in each image and store them in a database (Table 1) so that the module could generate the ROI base automatically from all the hyperspectral images in the image base. The ImageJ 6 program was used to locate the coordinates of the ROI.

2.3. Training and Optimization of the Network. The ROI base defined the ANN architecture for deep learning, but creating a hyperparameter architecture for each application remains difficult. Epochs, activation functions, and optimizers are hyperparameters. Manually testing several architectures takes time and effort. We optimize two scikit-learn machine learning hyperparameters. Without scikit-param learn's grid argument, a dictionary of hyperparameters must be provided. Apart from analysing each model (parameter set) in the dictionary, the cross-validation logo defines the result of two enhanced hyperparameters [16]. This study contains numerous parameter tests. Only the best after or tuning will

Table 1: Database of the ROI database generator module containing information on hyperspectral images (from left to right): image name, horizontal resolution, vertical resolution, ROI coordinate on the x-axis, and ROI coordinate on the y-axis and image class (CIS).

1	Image	x	y	coord_x	coord_y	coord_id↓
2	c4	193	241	102	99	c↓
3	c6	104	253	118	12	c↓
4	i1	204	253	144	104	i↓
5	i2	551	283	63	277	i↓
6	s12	272	128	37	199	s↓
7	s15	182	232	155	124	s↓

be shown. Cross-validation is widely used in statistics and machine learning to avoid overfitting. We used it to define two hyperparameters and test the ROI foundation. The holdout method is the most frequent for ANNs. The dice is used for RNA training and testing. The base plot used for training should not exceed 70% of the total data volume. The remaining 30% is used to evaluate model accuracy. A contemporary attorney was utilized as a starting reference. This last phase used an analytical cross-validation because the original experiment used a lot more data. K-fold cross-validation: this method divides the dice into K equal-sized groups (called folds). The process is repeated K times, providing K test error estimates for each K group. According to James et al., the classifier's average performance in K tests is 5-10 pa. A potassium blood test measures the amount of potassium in the blood. To improve the ANN's accuracy, multiple testing is justified. In most cases, K-fold cross-validation with $K = 5$ or 10 is employed to quantify the test error and variance (used in this experiment). After constructing ROIs, we used deep learning and K-fold cross-validation to train a classifier [9, 12]. The ANN classifier used in this study can diagnose hyperspectral images of colon cancer. Determining how to save RNA training data was critical since deep learning processing RNA can take hours or days. The Keras supports saving the final ANN model with deep learning architecture as a JSON file. The research was named nn strusture.json in Figure 2(h). The Keras allows a second non-HDF58 file. Along with the model, they are saved in *n* weights.h5. Finally, the production tooling module will load these two files and run the classification method.

2.4. Production Equipment. Production tooling is the core of the proposed system in this project. This module loads or classifies RNA using deep learning architecture (JSON file generated in the classifier training module), allowing classification of pixels in a hyperspectral image and pre-diagnosis of colon cancer biopsy examination. First, production tooling loads two files: nn strusture.json and nn weights.h. One of the challenges of this undertaking was separating the two paraffin areas. In the classifier training module, the classifier is limited to thirty regions matching tissues [4]. Non-biopsy tissue might create unwanted non-pre-diagnostic results, leading to false positives. The next procedure is to separate the hyperspectral image of the biopsy from the paraffin image. So, three DIP approaches are used: OTSU threshold, expansion, and erosion. In this case, a hyperspectral frequency was used to base a binary mask on. According to experts from the Photo Biophysics Laboratory, we utilized a frequency corresponding to a wave number equal to $1600\,\mathrm{cm}^{-1}$ to define the binary mask in this phase. Finally, using a binary mask, the object (fabric) is removed from the image background (paraffin) and brightness, peaks, and values are calibrated using dilation and erosion methods to limit fabric material loss.

The entire method Figure 6 employed the Python OpenCV9 package [12]. A library contains dozens of thresholding routines to help developers. Once the binary mask is created, the system compares the pixel coordinates of the hyperspectral image with the binary mask where, if the mask value is 0, the classifier ignores this pixel and production tooling defines its color as black. Two pixels are classified in this stage for pre-diagnosis. Other 3 matrices are generated: one for cancerous pixels (mC), one for inflamed pixels (mI), and one for healthy pixels (mH) (mS). Production tooling transmits all hyperspectral frequencies to the classifier or pixel for examination. The pixel is carcinogenic, and thus, production tooling just colors it red in the mC matrix. If the candidate pixel is inflamed, its mi matrix coordinate is green. Finally, bright pixels are blue in the mS matrix.

At the end of the process, the system generates a digital image in portable network graphics (PNG) format, in which each channel or RGB channel matrix corresponds to the colorization carried out by the RNA with the deep learning architecture (mC, mI, and mS), delivering no end to colorization two pixels per category. The production tooling also presents the user with the % age of pixels classified in each category. These stages constitute the pre-diagnosis of the system and will be detailed in results and discussions.

2.5. PAIH Web Interface. At the last stage of the project, the objective is the development of the layer of user interface (UI) that enables a simple interaction with the system. The UI operates as the frontend of production tooling, which, from a more technical point of view, deals with the backend litter of the system. Together with both layers, they complement the PAIH application.

The PAIH was developed with the objective of making it simpler for the user to interact with an RNA engine with deep learning architecture, proposed in this research. The frontend was programmed using the Web-enabled libraries (flask) of the Python programming language, as well as a set of development patterns and practices that facilitate code structure and reuse, such as design patterns [18] and other Internet technologies, such as HTML5, CSS, JSON, JavaScript, and AJAX. The initial interface, or PAIH, allows two types of possible actors to use the tool, either a researcher or a pathologist. Depending on the selected profile, the information presented does not subject the system to access alterations. In general, users with a researcher level have unrestricted access to the system files, and users with a pathologist level can only manipulate hyperspectral images in CSV, view digital H&E images, and perform pre-diagnoses. The limitation of access occurs because there is no need for pathologist users to have access, for example, to the FSM files, once they are used only in research activities, mainly aiming at contributions in future work. As its access by third parties violates the application rules, the application automatically recognizes and organizes directories and subdirectories containing a set of system-compatible files, such as hyperspectral images (FSM), digital images (PNG or TIFF), and CSV files. These directories are located on a server, making PAIH a repository of colon tissue biopsy tests in the cloud. To select a hyperspectral image in the selection box, the user can press the pre-diagnosis [10] button so that the production tooling engine is activated and the pre-diagnosis is processed. At the end of the process, the system

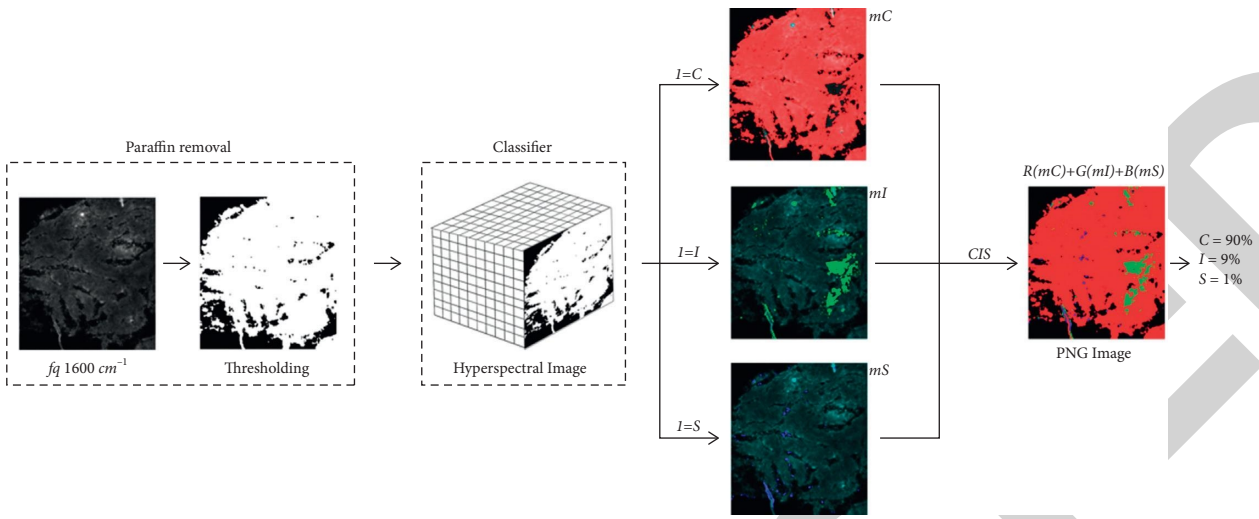
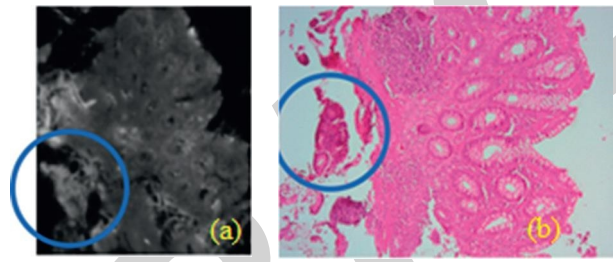


Figure 6: Paraffin removal process and classification of two pixels.



(a) (b)

Figure 7: (a) Hyperspectral image at a frequency corresponding to a wave number equal to 1600 cm^{-1}; (b) H&E image. Both face the same examination, as shown or highlighted circle, but they have different spatial characteristics.

exhibits H&E image, a hyperspectral frequency corresponding to a wave number equal to 1600 cm^{-1}, or a colorized pre-diagnosis result in a PNG image with a CIS classification and a % age of RNA success with deep learning architecture. It is possible to notice that the hyperspectral image and the H&E image [15] do not have the same resolution, ratio, and rotation and are still clearer than the highlight circle in Figure 7. This is an important point to be mentioned, so that there are no doubts regarding the authenticity of the pre-diagnosis performed by PAIH. This detail, despite being common and not presenting any problems in the RNA classification process with deep learning architecture, is present in all the images used in this research.

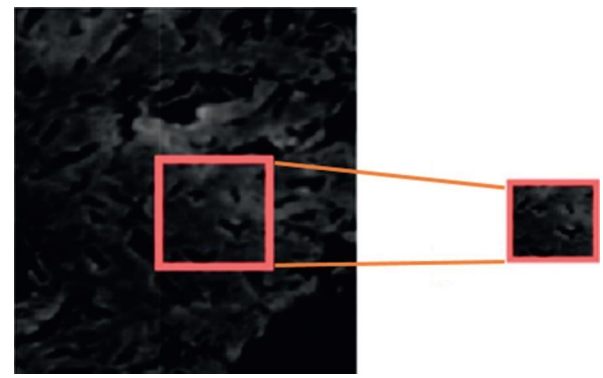


Figure 8: Hyperspectral image and its ROI, both at a frequency corresponding to a wave number equal to 1600 cm^{-1}.

3. Results and Discussions

3.1. Basis of ROIs. In the end, 27 ROIs were extracted (one of each available hyperspectral image), being 9 carcinogenic, 9 inflamed, and 9 healthy. Each ROI has a dimension of 50×50 pixels (total of 2500 pixels) and each pixel has 1626 frequencies to be analysed by the RNA with deep learning architecture. In sum, the pixels are the instances to be analysed and the frequencies are the attributes of each instance. The total number of pixels based on ROIs was 67500 pixels, with a disk volume totaling approximately 1.2 GB. As a way of validating the algorithm, the application will generate in a directory a ROI in PNG format (Figure 8). Despite the proven efficiency of the algorithm in executing the ROI cut, we believe it is important to carry out this concept test to minimize the probability of errors in the process. All the pixels are organized on the basis of ROIs

following the same scheme explained in Figure 5, where the lines represent pixels and the columns represent frequencies. It is important to highlight the reason for the conversion of the FSM file to CSV in this project. As mentioned, because it is an atypical file format, the first stage consisted of the conversion of the FSM format to another more popular one, which could be used.

All the resources of the two packages NumPy and Pandas of the Python programming language are enjoyed. Also, it was defined as CSV extension, a very common file format, easy to manipulate, and compatible with various Python resources. The conversation was carried out using the export function of the MATLAB application, which made it possible to identify important information (metadata) about two image files.

3.2. Tuning. Based on the nonmanual API of Keras and the related works described in Section 2 (state of the art), three different configurations have been tested using the GridSearchCV function. Each set of hyperparameters was referred to here as a scenario. At the end of the process, the GridSearchCV function returns the best hyperparameter to be used on the basis of ANN training with deep learning architecture, from the best_params attribute. The tuning process carried out was executed in the test environment of the dedicated server and the entire process lasted approximately 20 days and 6 hours. Foram tested the following hyperparameters:

(i) Units: it refers to the number of neurons used in hidden litters.

(ii) Batch_size: it is the number of batch samples used in one iteration.

(iii) Activation: it defines the best activation function.

(iv) Optimizer: it is an algorithm used to maximize the performance of the network in gradient descent.

(v) Epochs: it is the process cycle of the proposed scenario in architecture, in which it is repeated until some stop criterion is reached, normally the fact of changing weights will become very small.

It is important to highlight that there are works, which propose new methods and discuss the predefinition of hyperparameters for tuning to optimize the performance of an ANN. In this work, we opted for the use of the GridSearchCV function, but without leaving aside the importance of optimizing two hyperparameters, since the objective of this research phase is still part of the principle of validating the purpose of classifying two pixels. Also, other optimization models could be tested in future jobs.

3.3. Assessment. The cross-validation K-fold presented excellent results of accuracy in the three proposed scenarios in the tuning process. As shown in the graph of Figure 9, despite having a great difference in accuracy between the 1st scene and the other two, the difference in accuracy between the 2nd and 3rd scenes was practically null, when it exceeded 1000 processing times, oscillating in decimal values around 94%. Scenario 1 remained with an accuracy of around 80%, even arriving a 3000 epochs.

With this, let us keep as a choice Scenario 3, which despite having or doubling two values of the batch_size hypermeter and three times more times than Scenario 2, it did not present a significant difference in processing time, reaching an accuracy of 94.4%, no case, 0.2% more efficient than the Scenario 2, which showed 94.2% accuracy.

3.4. Pre-Diagnosis Tool. The first test executed in the PAIH tool was the pre-diagnosis of the 27 hyper-respective images that were used in the extraction of the ROIs for the construction of the classifier. The objective of this stage was to analyse whether the predominant class coincided (or did not) with the previous classification indicated by the pathologist. Figure 10 presents the results in the following order: (i) image ID: it identifies the selected file, where the first initial of the file corresponds to its class (CIS); (ii) class: it corresponds to the previous classification indicated by the pathologist (CIS); and (iii) accuracy of the RNA pre-diagnosis in each class (cancer, inflamed, or healthy): it is defined as the % age of pixels correctly classified in relation to class (highlighted in green).

All the 27 images obtained predominance in relation to the diagnosis previously made by the pathologist, with the majority giving an accuracy between 80% and 99%, indicating the efficiency of the developed classifier. Still, analysing each case, in the class of files with initials in C (carcinogenic), the highest accuracy was from the C11 file (Figure 11(a)), achieving 99.9% success and the lowest accuracy was from the C21 file (Figure 11)., achieving 71.2% correct. Mostly two files of this class obtained values above 88% correct, being the class better classified. In relation to the files with initials in I (inflamed), the highest accuracy was obtained in file I1 (Figure 11(c)), reaching 98.2% of success, and the lowest accuracy was obtained in the file I5 (Figure 11(d)), reaching 66.4% success. In this class, most of the two files also obtained values above 80% correct. Finally, in a class of files with initials in S (healthy), the highest accuracy was obtained in the S12 file (Figure 11(e)), reaching 99.5% correct, and the lowest in the S2 file (Figure 11(f)), reaching 54.2% success rate, being the lowest ranking among all the classes. In this class, most of the two files also obtained accuracy values above 80%.

Finally, there is no pre-diagnosis validation process for the production tooling of the PAIH application, so we will not participate in the final pre-diagnosis test in the 27 photographs used to construct the base of ROIs and trained no classifier. The results matched a pathologist's manual diagnosis. As seen in Figure 10(g), the color red dominates. The ANN with deep Learning architecture also accurately diagnoses the hyperspectral image, with 92.6% of the tissue area identified as cancer, 7.4% as inflamed (green), and 0% as healthy (blue). Figure 11(h) shows a green color predominance, with 71.9% of the tissue classified as inflammation, 3% as cancer, and 25.1% as healthy. Finally, Figure 11(i) is largely blue, with 81.3% healthy fabric, 17.7% cancer, and 1% inflammation. Inflammatory tissue is common in malignant

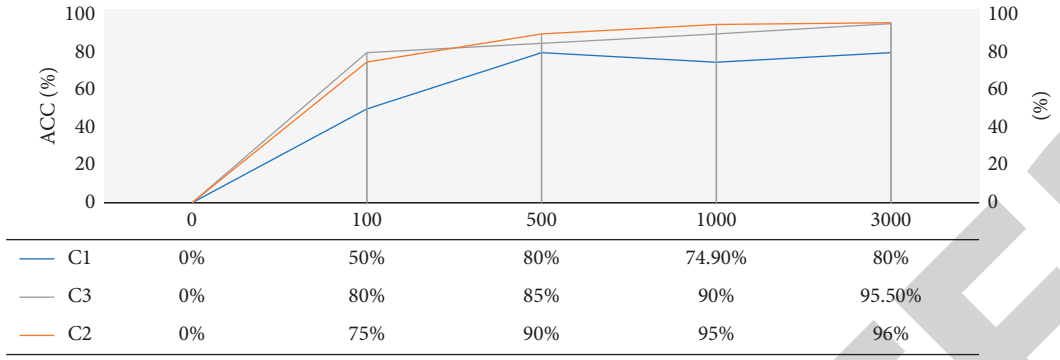


Figure 9: Comparison of accuracy between the proposed scenarios for ANN with deep learning architecture.

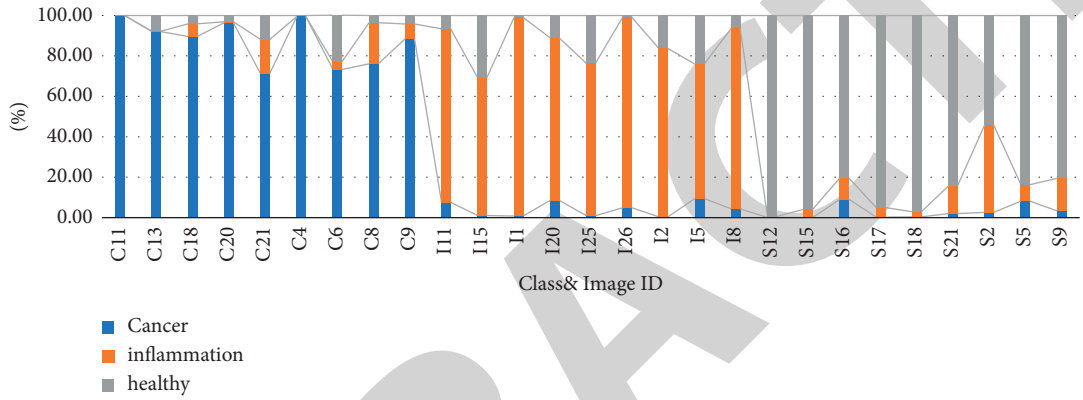


Figure 10: Results of the pre-diagnosis test on the images used in the extraction of ROIs for the construction of the classifier.

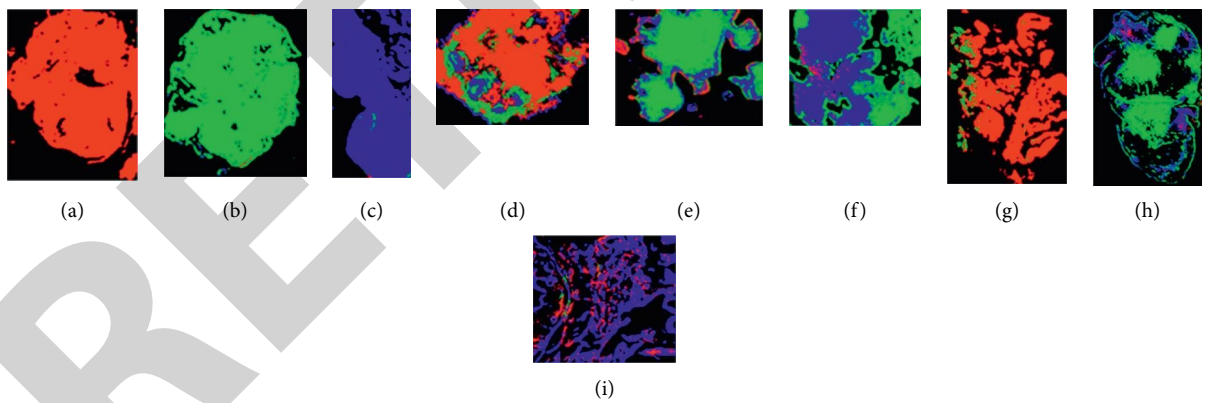


Figure 11: Ratio of two highest and lowest results by class and results of the pre-diagnosis performed by production tooling: (g) image C18 with a predominance of cancer (red); (h) image I1 with a predominance of inflammation (green); (i) S10 image with a predominance of healthy tissues. All coincide with the previous classification indicated by the pathologist.

sites. Figure 3 shows 7.4% of inflammatory tissues. Despite their small size, the red dots in Figure 3 may indicate a classifier error. Since each pixel must be classified, 27 ROIs are a respectable number, but for a production system, additional new examples based on ROIs would be required to refine or train the classifier. The classifier's result will be the larger or better set of tests, and the error estimate will be the larger or more exact set of tests. In certain circumstances, homogenization algorithms can help. Similarly, the CIS categorization of a hyperspectral image could be separated into homogenous zones based on a color characteristic and then evaluated individually or together. Finally, considering the test conditions, the computing cost was also noteworthy. Pre-diagnosis of production tooling in a conventional computer system has proven to be quite efficient, taking roughly 45 seconds for each exam. This time was nearly the same on a dedicated server. Despite the categorization process's complexity, the system proved to be quick enough

in a production context. Nonetheless, in all testing, the categorization process used a lot of RAM. No ordinary computer (16 GB RAM) or classification method used 3–5% of RAM per pre-diagnosis (480–800 MB), indicating no dedicated server. In a Web environment, where tens or hundreds of tests might be run simultaneously, we believe that a more thorough investigation of this usage in a production setting is required.

4. Conclusions

The aim of this study was to identify inflammatory and malignant tumours in colon biopsy samples using infrared spectra. Hyperspectral imaging was thought to identify anomalies embedded in its pixels' spectrum. It can classify pixels in hyperspectral images as cancerous, inflammatory, or healthy. This pre-diagnosis of colon cancer is based on two classifier tests and two studies.

Our findings reveal that RNA structural changes caused by Web applications (PATH) can facilitate the direct binding of m6A-modified RNAs to low-complexity sites in RNA binding proteins.

The tool's design allows future research on hyperspectral pre-diagnosis of problems to be added into its engine.

(i) Two PAIH resources can be revalued from the generation of new RNA structures and hyperparameters utilizing deep learning architecture, simply by importing a new JSON file for the hardware.

(ii) This allows researchers to quickly generate batch pre-diagnosis data.

(iii) The Web module works on any device with a standard Web browser because the system does not need add-ons or cookies.

(iv) Various users may have varying levels of access, allowing data manipulation.

One of the app's flaws is converting two FSM files to CSV. The dependency on the program can cause issues. In addition, training two pixels from a ROI base takes a long time. On a dedicated server, the training will last roughly 48 hours. Using new input images as passive artefacts for future training may necessitate precise scheduling between application uses and training period environment. Advanced settings and methods can be assessed once additional data and circumstances are understood.

Only a pathologist's interpretation can give true meaning to the data, generating the examination's diagnosis. A second pathologist's perspective may increase precision and reduce subjectivity [19].

4.1. Future Work. As proposals for future work, we can mention the following:

(i) ROIs are read and built from two FSM files of hyperspectral pictures straight to speed up the procedure.

(ii) Co-registration techniques are used to align the H&E image with the hyperspectral image.

(iii) Homogenization algorithms are used to reduce false positives in two-pixel classification and make the digital image, content, or pre-diagnosis result more aesthetically appealing for two-user interpretation.

(iv) Evaluating alternatives further, while the results in Figure 8 show a modest oscillation between scenarios 2 and 3, we believe that fresh scenario recommendations may produce different results. 94% accuracy was enough to allow us to advance in all phases of the investigation.

(v) The PAIH tool's visual resources are improved to allow pathologists to digitally demarcate new ROIs in hyperspectral images for ANN classifier integration with deep learning architecture.

Data Availability

The data underlying the results presented in the study are available within the manuscript.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

References

[1] S. Sheet, A. Sheikha, A. Saeed, H. Ameen, S. Mohammed, and M. Khasraw, "Colorectal cancer: is the incidence rising in young Iraqi patients?" *Asia-Pacific Journal of Clinical Oncology*, vol. 8, no. 4, pp. 380-381, 2012.

[2] A. Signoroni, M. Savardi, A. Baronio, and S. Benini, "Deep learning meets hyperspectral image analysis: a multidisciplinary review," *Journal of Imaging*, vol. 5, p. 52, 2019.

[3] V. Blanes-Vidal, G. Baatrup, and E. S. Nadimi, "Machine learning-based colorectal cancer detection," in *Proceedings of the 2018 Conference on Research in Adaptive and Convergent Systems*, Honolulu, HI, USA, September 2018.

[4] I. Pacal, D. Karaboga, A. Basturk, B. Akay, and U. Nalbantoglu, "A comprehensive review of deep learning in colon cancer," *Computers in Biology and Medicine*, vol. 126, Article ID 104003, 2020.

[5] K. Rajpoot and N. Rajpoot, "Wavelet based segmentation of hyperspectral colon tissue imagery," in *Proceedings of the 7th International Multi Topic Conference*, pp. 38–43, Islamabad, Pakistan, December 2003.

[6] F. Manni, R. Navarro, F. Van der Sommen et al., "Hyperspectral imaging for colon cancer classification in surgical specimens: Towards optical biopsy during image-guided surgery," in *Proceedings of the 2020 42nd Annual International Conference of the IEEE Engineering in Medicine & Biology Society*, pp. 1169–1173, Montreal, Canada, July 2020.

[7] Y.-H. Wang, P. A. Nguyen, M. M. Islam, Y.-C. Li, and H.-C. Yang, "Development of deep learning algorithm for detection of colorectal cancer in EHR data," *Studies in Health Technology and Informatics*, vol. 264, pp. 438–441, 2019.

[8] S. H. Bouazza, N. Hamdi, A. Zeroual, and K. Auhmani, "Gene-expression-based cancer classification through feature selection with KNN and SVM classifiers," in *Proceedings of the*

Hindawi
Journal of Environmental and Public Health
Volume 2023, Article ID 9861737, 1 page
https://doi.org/10.1155/2023/9861737

Retraction

Retracted: Assessment of the Knowledge Level of First Aid among Medical Students in Work Environment

Journal of Environmental and Public Health

Received 27 January 2023; Accepted 27 January 2023; Published 7 February 2023

Journal of Environmental and Public Health has retracted the article titled "Assessment of the Knowledge Level of First Aid among Medical Students in Work Environment" [1] due to concerns that the peer review process has been compromised.

Following an investigation conducted by the Hindawi Research Integrity team [2], significant concerns were identified with the peer reviewers assigned to this article; the investigation has concluded that the peer review process was compromised. We therefore can no longer trust the peer review process, and the article is being retracted with the agreement of the Chief Editor.

The authors do not agree to the retraction.

References

[1] Asma Alanazi, Saad Algethami, Mohammed Alnafisah, Saoud Alhussayen, Fares Almutairi, Sultan Almureef, Maram Albalawi, and Farida Habib, "Assessment of the Knowledge Level of First Aid among Medical Students in Work Environment," *Journal of Environmental and Public Health*, vol. 2022, Article ID 8381819, 5 pages, 2022.

[2] L. Ferguson, "Advancing Research Integrity Collaboratively and with Vigour," 2022, https://www.hindawi.com/post/advancing-research-integrity-collaboratively-and-vigour/.

Hindawi
Journal of Environmental and Public Health
Volume 2022, Article ID 8381819, 5 pages
https://doi.org/10.1155/2022/8381819

Research Article

Assessment of the Knowledge Level of First Aid among Medical Students in Work Environment

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Received 8 April 2022; Revised 20 April 2022; Accepted 9 May 2022; Published 30 May 2022

Academic Editor: Sivakumar Pandian

First aid is one of the most important life-saving skills a health provider specifically or anybody generally must have. It can be defined as the first treatment one provides at the site of the accident to the injured person until full medical treatment is available. In some emergency situations, simple first aid can make a life-or-death difference. *Aim*. This study is designed to evaluate the knowledge of first aid among medical students at KSAU-HS in Riyadh, Saudi Arabia. *Methods*. The cross-sectional study is conducted in KSAU-HS, Riyadh, about the knowledge of first aid among medical students. A self-administered structured questionnaire is used for the purpose of data collection. The main variables are as follows: to compare the knowledge of first aid between male and female medical students, among different years of study, and identify the percentage that have knowledge of first aid. *Results*. Out of 326 students, 10 students (3.1%) scored excellent, 99 (30.4%) good, 136 (41.7%) average, 75 (23%) poor, and 6 (1.8%) very poor. *Conclusion*. The level of knowledge improved with the advancement in years, but this was not sufficient, and more training should be given to all medical students on first aid.

1. Introduction

What is first aid and how important is it? Well, it is an important life-saving skill a health provider specifically or anybody generally must have. One can define it as the first treatment provided at the site of the accident to the injured person until full medical treatment is available. First aid can make a life-death difference on emergencies. The Red Cross survey found that if first aid was conducted before ambulance arrives, it can prevent 59% of deaths [1–3].

Locally, a study was conducted in 2018 to evaluate the knowledge of first aid among medical students at King Saud University with a sample size of 200, 50% males and 50% females made up of 40 students (20%) from each year, 68% of students correctly answered first aid questions, with fifth-year students displaying a higher degree of knowledge. However, there were no significant differences in information between the first, second, or third-year students. The study notes that statistically there is no significant gap in first aid skills between male and female students [4–6].

Likewise, Princess Norah University conducted a study in 2019 with a sample size of 1000 female students to determine the knowledge of medical students and nonmedical students about first aid skills. It was shown by the result that only 34.7% had excellent knowledge, 57.5% had medium knowledge, and 7.8% had poor first aid knowledge [7, 8]. A study was also conducted in 2019 at Taif University about the awareness, knowledge, attitudes, and practices of first aid skills among medical and nonmedical students. It was found that 56.6% of 500 participants had good first aid knowledge, while 43.4% were poor. Medical students also had a higher level of awareness than literary or other science students [9].

From a global perspective, based on a study of 152 students done at the medical college in Mangalore city, south

Analysis Variable : Scoring										
Batch	Gender	N Obs	N	N Miss	Mean	Std Dev	Median	Quartile Range	Minimum	Maximum
15	Male	53	53	0	22.69	5.76	23.50	8.00	10.00	36.00
	Female	32	32	0	20.63	8.30	21.25	15.00	4.50	33.00
16	Male	57	57	0	22.57	5.33	22.00	7.50	9.00	34.00
	Female	30	30	0	21.53	7.29	21.00	13.00	9.50	34.50
17	Male	52	52	0	22.79	5.91	22.50	6.75	7.50	38.00
	Female	25	25	0	21.90	5.41	22.00	7.00	12.00	32.00
18	Male	50	50	0	18.46	6.52	19.50	10.50	7.00	31.00
	Female	27	27	0	21.00	6.60	23.00	11.50	11.00	34.50

Figure 1: Demographic data according to batch, gender, and measures of central tendency.

India, in 2011, only 11% of them had previous first aid training. A total of 13% of students had good knowledge, 68.4% of students had moderate, and 17.8% of students had poor knowledge of first aid [10, 11]. An additional study carried out at Vydehi Medical College in Bangalore found that 150 medical students filled out the questionnaire, 50 from each of 5th (2nd year), 7th (3rd year), and 9th terms (4th year). The overall scores were as follows: 43 out of 150 students had excellent knowledge, 71 out of 150 needed improvements, 35 out of 150 had adequate knowledge, and only 1 out of 150 had poor knowledge in first aid. There was a statistically significant association between terms and level of knowledge [12–14]. Likewise, in a study on 222 final year students conducted at AIMST University, Malaysia, during June and August in 2018, majority of the students were females which accounted for approximately 63%, and the males were the rest 37%. The students included 3 different faculties with 33.3% (74) from pharmacy faculty, 32.9% (73) from dental faculty, and 33.8% (75) from medical faculty. Overall, the medical students recorded the most correctly answered questions in comparison to students from the pharmacy and dental schools, indicating that there is a significant difference in knowledge among the 3 faculties [15].

Despite of all these, first aid is a crucial skill for everyone, as anyone could face emergencies during their day. In a specific manner, junior doctors or medical students are generally expected to be able to perform basic life support skills, including cardiopulmonary resuscitation (CPR) in an emergency [16–18].

In the previous studies that have been mentioned earlier, the knowledge of first aid was not as good as expected. Furthermore, this study was conducted, so that these expectations can be met and the knowledge of first aid can be evaluated. Also, no studies have been done in KSAU-HS on this topic. The contribution of study is assessing the knowledge of first aid among the medical students of KSAU-HS, Riyadh.

2. Methods

The study is a cross-sectional design. In a cross-sectional study, the information is collected at one point in time as the objective of the study is the assessment for knowledge and attitude; thus, a cross-sectional study is the optimum study design for this project. A self-demonstrative questionnaire-based study targets the medical college of King Saud bin Abdulaziz University of Health Sciences (KSAU-HS) in Riyadh, Saudi Arabia. KSAU-HS was founded in 2005, and it is located in King Abdulaziz Medical City, which is one of the four medical cities in Riyadh [19, 20]. It contains five colleges which are the college of medicine, science and health professions, dentistry, pharmacy, and applied medical science, with male and female college students. All students currently enrolled in the college of medicine will be included in the study population. In 2021, there are approximately 326 students practicing and studying medicine in KSAU-HS, college of medicine in Riyadh. Inclusion criteria were as follows: both male and female medical students of KSAU-HS from 3rd year to 6th year (batches 18, 17, 16, and 15). The questionnaire is designed in English language. It is divided into two parts: the first part includes demographic data of medical students and the second part is involved in assessing medical student's knowledge about first aid. The questionnaire will be developed and validated by experts, and the pilot study will be used to find reliability. The data will be collected by the coinvestigators in the research team. After the collection of the sheets, each sheet is coded into serial numbers using Excel 2016. The data are transferred to SAS version 9.4 for analysis. Categorical variables such as years of study and knowledge level are given as percentage and frequencies. Numerical variables (student's age and total knowledge score) are reported as mean and standard deviation. The chi-square test was used to find association between the two categorical variables (e.g. knowledge level and year of the study). All statistical tests are considered significant with p value less than 0.05. The proposal was

Score_	Frequency	Percent
Very Poor	6	1.84
Poor	75	23.01
Average	136	41.72
Good	99	30.37
Excellent	10	3.07

Figure 2: Five-point rating scale.

Analysis Variable : Scoring									
Do you have any previous k0wledge on the first aid field?	N Obs	N	N Miss	Mean	Std Dev	Median	Quartile Range	Minimum	Maximum
No	112	112	0	18.71	6.90	18.50	10.50	4.50	34.00
Yes	214	214	0	23.00	5.64	23.00	7.00	7.00	38.00

Source	DF Type III	SS Mean Square	F Value	Pr > F
Do_you_have_any_prev	1	1353.209178	1353.209178	36.35	<.0001

Figure 3: A strong association between previous knowledge of first aid and test scores.

Table of Score_ by Batch					
Score_	Batch (Batch)				
Frequency Col Pct	15	16	17	18	Total
Very Poor	2 2.35	0 0.00	2 2.60	2 2.60	6
Poor	20 23.53	18 20.69	10 12.99	27 35.06	75
Average	27 31.76	42 48.28	38 49.35	29 37.66	136
Good	34 40.00	22 25.29	25 32.47	18 23.38	99
Excellent	2 2.35	5 5.75	2 2.60	1 1.30	10
Total	85	87	77	77	326

Statistic	DF	Value	Prob
Chi-Square	12	22.6421	0.0309
Likelihood Ratio Chi-Square	12	23.9560	0.0206
Mantel-Haenszel Chi-Square	1	4.3132	0.0378
Phi Coefficient		0.2635	
Contingency Coefficient		0.2548	
Cramer's V		0.1522	

WARNING: 40% of the cells have expected counts less than 5. Chi-Square may not be a valid test.

Figure 4: A strong association between the batch of participants and test scores.

submitted to the Research Unit of the College of Medicine and KAIMRC (King Abdullah International Medical Research Center) and has been approved [21]. All the participants were given an informed consent form along with the questionnaire, and the participation in the study was voluntary. The participants were free to withdraw if they wanted; also, no compensation or benefit was given to the participants. No information related to personal identification of the participants was taken. All the data collected are kept confidential, and only the research team has access to it. Anonymity of the participants is kept throughout the study and afterwards in dissemination as well.

3. Results Section

3.1. Demographic Data. Data were obtained from 329 medical students (215 males and 114 females) (Figure 1) at KSAU-HS, Riyadh, Saudi Arabia, by a survey which measures the knowledge level of first aid. The survey was divided into two sections: demographic and 20 MCQs. Moreover, three surveys were removed because they were uncompleted. The scoring system was a five-point rating scale (Figure 2), the lowest was very poor, and the highest was excellent. 10 students (3.1%) scored excellent, 99 (30.4%) good, 136 (41.7%) average, 75 (23%) poor, and 6 (1.8%) very poor.

4. Discussion

The present cross-sectional study was carried out among 329 medical students (215 males and 114 females) at KSAU-HS, Riyadh, Saudi Arabia. We measured the level of first aid knowledge. The survey included two sections: demographic and 20 MCQs. The overall mean of the students was 21.53, while no students got a full score, and the maximum score was 38. We view this as reflecting the average knowledge of first aid. Also, the results showed a strong association with previous knowledge of first aid and the batch of students [22–24].

According to Figure 3, 214 students who had previous knowledge, certificate, and courses had higher scores in comparison to the other students. This could indicate that not only medical knowledge is sufficient to know first aid but also participating in first aid workshops, sessions, outsourcing, and attending conferences can sufficiently increase your knowledge of first aid.

According to Figure 4, we found that there is a significant difference between medical students who are in different

medical school years. Batch 15 had significant higher scores than batch 18 which proves that the more advanced the students are, the more knowledge they have about first aid. 85 students from batch 15 (53 of whom are males and 32 are females) scored an overall mean of 22.69 for males and 20.63 for females. 77 students from batch 18 (50 of whom are males and 27 are females) scored an overall mean of 18.46 for males and 21.00 for females. This supports both facts that not only advancement of medical school years increases knowledge, which was indicated by the males of batches 15 and 18, but also outsourcing, attending workshops, conferences, and sessions also increase knowledge of first aid which was indicated by the females of batches 15 and 18.

In comparison to previous studies, one of which is a cross-sectional study which was conducted in a medical college in Mangalore city of south India, the total participants were 152, similar to our results. 13.8% had good knowledge, 68.4% had moderate, and 17.8% had a poor level of knowledge. Another study which was conducted in undergraduate medical students of Vydehi Medical College, Bangalore, included 150 students. The overall scores were as follows: 43 out of 150 students had excellent knowledge, 71 out of 150 needed improvements, 35 out of 150 had adequate knowledge, and only 1 out of 150 had poor knowledge about first aid. Another study was conducted in 2017 at Collegium Mazovia Innovative University in Siedlce, Poland. It included 200 part-time students. 38% were very good, 51% were good, 11% were average, and 0% had lack of knowledge. In addition, a local cross-sectional study was conducted in Abha at King Khalid University. Out of 703 students, 253 were medical students, and among those medical students, 58.1% answered correctly less than 50% of questions, 20.2% answered 50–70% of the questions correctly, and 21.7% answered more than 70% of the questions.

One of the limitations during this research study was excluding batch 19 premedical students. In addition, we faced some difficulties during data collection, one of which was that the females were in a different building, and we could not reach and distribute the survey easily. Also, COVID-19 caused some difficulties in the data section because all facilities in the campus required precautionary measures.

5. Conclusion

First aid knowledge among medical students needs improvement. Out of 326 medical students who participated in the study, only 33.4% had good score or higher (24 or higher). The students who had a previous knowledge got a better score than those who had no knowledge before. In addition, the level of knowledge improved with the advancement in years, but this was not sufficient, and more training should be given to all medical students on first aid. We would recommend that all students either medical or nonmedical should receive mandatory first aid classes. These classes could be online sessions or in campus. Also, there should be increased awareness of first aid among the general population.

Data Availability

The data used to support the findings of this study are included within the article.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

References

[1] Z. Aljarad, J. Ataya, and J. Ataya, "Assessment of first-aid knowledge among medical students in Syria: A cross-sectional study," 2021, https://www.researchgate.net/publication/348502299_Assessment_of_First-Aid_Knowledge_Among_Medical_Students_in_Syria_A_Cross-Sectional_Study.

[2] Z. Ahmed, K. K. Bhinder, A. Tariq et al., "Knowledge, attitude, and practice of artificial intelligence among doctors and medical students in Pakistan: a cross-sectional online survey," *Annals of Medicine and Surgery*, vol. 76, Article ID 103493, 2022.

[3] M. B. Alazzam, A. T. Al-Radaideh, N. Binsaif, A. S. AlGhamdi, and M. A. Rahman, "Advanced deep learning human herpes virus 6 (HHV-6) molecular detection in understanding human infertility," *Computational Intelligence and Neuroscience*, vol. 2022, Article ID 1422963, 5 pages, 2022.

[4] E. Hammmett, "First aid for life. Retrieved from first aid for life," 2019, https://firstaidforlife.org.uk/first-aid/.

[5] N. A. Almoammar, A. Fathalla, F. F. Alotaibi et al., "Assessing the level of first-aid knowledge among undergraduate medical students in King Saud University," *International Journal of Pharmaceutical Research and Allied Sciences*, vol. 7, pp. 58–63, 2018.

[6] R. Riaz, L. Riaz, J. Khan, and M. Baloch, "Survey on knowledge of first aid management of burns amongst medical and non-medical students in Karachi, Pakistan: need for an educational intervention?" *Cureus*, vol. 12, 2020.

[7] M. B. Alazzam, H. Al Khatib, W. T. Mohammad, and F. Alassery, "E-health system characteristics, medical performance, and healthcare quality at Jordan's health centers," *Journal of Healthcare Engineering*, vol. 2021, Article ID 5887911, 7 pages, 2021.

[8] M. Liang, Q. Chen, J. Guo et al., "Mental health first aid improves mental health literacy among college students: a meta-analysis," *Journal of American College Health*, pp. 1–10, 2021.

[9] M. Lubna, S. D. Alghamdy, S. D. Halawani, M. M. Alwazae, and W. A. Alkhayal, "Knowledge and attitude of Saudi female university students about first aid skills," *Journal of Family and Community Medicine*, vol. 26, pp. 103–107, 2019.

[10] D. Alistwani, R. A. Addin, and A. Ammar, "Assessing knowledge of first aid management of burns amongst Syrian Private University students," 2022, https://assets.researchsquare.com/files/rs-1404755/v1/26a13b76-12bd-4502-b755-fc79f6bee3da.pdf?c=1646692748.

[11] R. M. Alnefaie, "Awareness, knowledge, attitude and practices of first aid," *Middle East Journal of Family Medicine*, 2019.

[12] M. K. Al-Azzam, M. B. Alazzam, and M. K. Al-Manasra, "MHealth for decision making support: a case study of EHealth in the public sector," *International Journal of Advanced Computer Science and Applications*, vol. 10, no. 5, pp. 381–387, 2019.

Hindawi
Journal of Environmental and Public Health
Volume 2023, Article ID 9867104, 1 page
https://doi.org/10.1155/2023/9867104

Retraction

Retracted: Securitization Concept and Its Application to Environmental Problems in the Kurdistan Region: Prospects and Obstacles

Journal of Environmental and Public Health

Received 14 February 2023; Accepted 14 February 2023; Published 9 March 2023

Journal of Environmental and Public Health has retracted the article titled "Securitization Concept and Its Application to Environmental Problems in the Kurdistan Region: Prospects and Obstacles" [1] due to concerns that the peer review process has been compromised.

Following an investigation conducted by the Hindawi Research Integrity team [2], significant concerns were identified with the peer reviewers assigned to this article; the investigation has concluded that the peer review process was compromised. We therefore can no longer trust the peer review process, and the article is being retracted with the agreement of the Chief Editor.

Nusret Sinan Evcan agrees to the retraction; Salam Abdulqadir Abdulrahman was unresponsive.

References

[1] S. A. Abdulrahman and N. S. Evcan, "Securitization Concept and Its Application to Environmental Problems in the Kurdistan Region: Prospects and Obstacles," *Journal of Environmental and Public Health*, vol. 2022, Article ID 8122568, 9 pages, 2022.

[2] L. Ferguson, "Advancing Research Integrity Collaboratively and with Vigour," 2022, https://www.hindawi.com/post/advancing-research-integrity-collaboratively-and-vigour/.

Hindawi
Journal of Environmental and Public Health
Volume 2022, Article ID 8122568, 9 pages
https://doi.org/10.1155/2022/8122568

Research article

Securitization Concept and Its Application to Environmental Problems in the Kurdistan Region: Prospects and Obstacles

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Received 24 March 2022; Revised 11 April 2022; Accepted 4 May 2022; Published 26 May 2022

Academic Editor: Sivakumar Pandian

Environmental pollution has caused a wide range of problems across the globe. Various studies have focused on worldwide water and environmental issues and their effects on human health and political and social aspects. This article, on the other hand, discusses soil, water, and air pollution as well as the overuse of water resources. This study then discusses these problems as a security issue in the Kurdistan Region of Iraq (KRI) context. This research adopts a qualitative approach. It reviews the results of previous studies on soil, water, and air pollution in KRI to demonstrate the causes and scale of the problem. It then explores securitization by looking at the main components of the concept and how they can be applied and what needs to be adjusted. Results of the study have shown that pollution is widespread, water is overexploited, and there is a lack of an effective response by the Kurdistan Regional Government (KRG). In addition, in the KRI context, securitization is state-centered, meaning that the country's decision-makers play an important role in securitizing issues. The Kurdistan Regional Government, that is, the securitizing actor, should do more on the speech act, and this should be preceded by substantial political, economic, and psychological changes. Finally, the government must also enforce strict water control to support its water policies.

1. Introduction

The overthrow of Saddam Hussein in 2003 was the beginning of a new era in Iraq. It came after years of war, economic sanctions, and international isolation. Iraq was then able to do trade with the outside world and make deals with foreign companies. This opportunity was quickly seized in KRI. Having been outside the administrative authority of the Iraqi government since 1992, KRI was better organized to take advantage of the new opportunity. KRI increased its volume of trade, mainly importing goods and services from other countries, especially from Turkey and Iran, and expanded investment in the construction and energy sectors. Its economy started to grow, together with the expansion of its urban centers. Many people from rural areas migrated to the cities, and numerous people got jobs in the public sector or registered with KRG to receive a monthly allowance. These changes were spurred on by the rise in income for the KRG, which was mostly from oil exports.

Yet these changes have had serious consequences for the environment. Increasing waste matters and wastewater from the expanding urban centers pollute soil and render both the surface water and groundwater unsuitable for drinking and even irrigation, and there is an increasing need for land to be used as landfills and dumpsites. In KRI, waste and wastewater are largely not recycled or treated. The soil is also polluted by the growing oil industry and other industrial activities. Water is polluted by human activities, and water as a resource is overexploited. The demand for water from expanding urban areas and agriculture is rising to an unprecedented level. This has led to the overwithdrawal of both groundwater and surface water. And the air quality in KRI is rapidly deteriorating. An unprecedented number of cars on the roads, together with a huge number of privately owned electricity generators and other industrial activities, have turned the air quality in KRI into one of the worst in the world.

The damage to the environment continues apace, but no significant recovery program is in place. As we demonstrate, immediate and exceptional measures should be taken by the government that can be achieved by transforming the existing regime of practice and allocating sufficient human and financial resources for as long as and as much as it takes, i.e., to securitize the matter and elevate it to the top of the government agenda. This is securitization in action, and it can be done in KRI if certain things happen, like the political organization of society, the economic system, and the psychological state of people, to make the securitization work.

This paper is divided into three sections. In the first section, we study the pollution of soil, water, and air in KRI and focus on its causes. We also study the overexploitation of the natural resources of water. In the second section, we look at the securitization concept and explain its components. The researchers also clarify how it can be applied to the situation. In the third and final section, the researchers look at the political, economic, and psychological impediments to active securitization. The researchers end the paper by talking about how one of the most important problems in KRI is not getting enough attention but is still very important and highlight the main problems that still need more advanced solutions in this matter.

The Kurdistan Region of Iraq is situated in the northeast of Iraq. It consists of four governorates: Erbil, with an estimated population of 2.2 million; Sulaymaniyah, with an estimated population of 2.1 million; Duhok, with an estimated population of 1.6 million; and Halabja, with an estimated population of 115.4 thousand. Since 1992, KRI has been a selfadministered area in Iraq. Its legal status is recognized in the new Iraqi constitution, which was approved in a national referendum in 2005, two years after the overthrow of the former Iraqi dictator. It covers an area of about 40 000 km^2. The Kurds constitute the majority of its population, along with other ethnic and religious minorities. KRI's neighbors are Iran on the east, Turkey on the north, and Iraq on the west and south [1, 2]. KRI is the only place in the world where the Kurds have a degree of autonomy. The Kurds are the largest nation in the world without a state. Following the fall of the Ottoman Empire in the early 20th century, their land was split up between Turkey, Iran, Iraq, and Syria.

The aim of the research is to highlight serious environmental problems in KRI, namely, the pollution of the main environmental components, the pollution of soil, water, and air, and the overexploitation of water resources, and explain how they have happened. It is also to argue for the relevancy of securitization to the problem, but also how securitization as a concept and process will need to be attuned to the situation.

2. Problem, Methodology, and Contribution

To state the problem of the research, we can say that the overthrow of Saddam Hussein's regime in Iraq in 2003 was the beginning of a new era in the country; the decade-long economic and trade sanctions were lifted so Iraq could once again interact with the outside world for trade and other transactions. This opportunity was best seized by the semiautonomous KRI. KRI had been selfadministrated since 1992, which meant that it had functioning government institutions prior to the regime change.

The new situation allowed trade with the outside world and the acceleration of economic growth, which also meant the growth of urban areas. However, these developments have caused significant damage to the KRI environment. The KRG has largely ignored the effects of economic and urban development on the environment, especially the pollution of soil, water, and air and the damage to the water resources.

The scale of the damage is huge and should not be ignored anymore, and it requires rapid action and effective solutions to be taken by the authorities. This research paper looks at the problem and assesses it from a securitization perspective, meaning that the government's priority must change to the environment and the country's financial and human resources must be diverted to solving the urgent environmental threats, the pollution of the main environmental components, and the overexploitation of water. The research also looks at the main obstacles to securitization and argues that when applied to local environmental problems, the nature of the securitization process will change and so the concept needs to be reassessed.

This research adopts a qualitative approach. It reviews the results of previous studies on soil, water, and air pollution in KRI to demonstrate the causes and scale of the problem. It then explores securitization by looking at the main components of the concept and how they can be applied and what needs to be adjusted.

The research will have two main contributions. The first contribution comes from its attempt to use securitization in specific areas of the environment, namely, pollution and resource overexploitation. And the second contribution comes from the adjustments that need to happen to the process of securitization when applied to local environmental problems and the implications of this for the concept.

2.1. Environmental Problems in KRI. In this section, we highlight two main areas of environmental problems in KRI: first, the pollution of the soil, water, and air; and second, the overexploitation of water resources. Both problems are getting worse by the day, and they threaten the well-being of people and the sustainability of the environment. Threats like these constitute security issues [3] since they are directly related to the survival or well-being of the people. Therefore, they require to be treated urgently and with the utmost effort.

Soil pollution in KRI has three main sources. The first source is industrial activities in general and the oil industry in particular [4]. Heavy metals (i.e., arsenic, copper, chromium, cadmium, cobalt, iron, manganese, molybdenum, nickel, lead, and zinc) have been found in large quantities in the soil around industrial areas as well as in urban centers [5], and extraction, refining, and transportation of oil have created immense pollution [6]. There are many oil refineries, licensed and unlicensed, in KRI that occupy vast areas of

land and discharge their effluents into the environment. These activities cause soil contamination and destroy agricultural lands on a large scale [7]. Another source of soil pollution is the transport of crude oil and petroleum derivatives by tanker trucks to and from neighboring countries. There are around 5,000 oil tanker trucks on KRI roads every day, and accidents often happen because of bad roads, faulty trucks, or bad driving [8]. Some of these accidents result in the spillage of huge volumes of oil and the contamination of wide areas of land.

The second source of soil pollution is municipal solid waste, mainly in urban areas [9]. Urbanization and a change in lifestyle for many people have led to an increase in the consumption of all sorts of goods and, consequently, an increase in waste material. Almost all the solid waste ends up in open dumpsites or landfills [10], and some of these places are not very far from the residential areas. In some dumping lands, the solid wastes are burned haphazardly, with the air pollution distribution of a rotten odor [11]. There are also unauthorized dumpsites in many areas. More and more land is being used for increasing municipal solid waste.

The third source of soil pollution is waste from urban centers and other residential areas. Untreated wastewater (there is no system in place to separate wastewater into grey and black, it is all mixed) mixes with the rivers or creeks and continues traveling through the land. Wastewater released by sewerage pipes or tunnels is a source of surface and subsurface soil pollution in KRI. The wastewater of Sulaymaniyah city, which pours into the Tanjaro River, is an example in that regard [12]. Other areas that do not have sewerage systems, including all the villages, rely on cesspits for the disposal of their waste. The cesspits allow the wastewater to spread through and pollute the soil as well as the groundwater.

The water is increasingly polluted in KRI. The sources of surface water pollution are wastewater and industrial discharges, including discharges from oil refineries and agricultural farmlands. Untreated wastewater from these sources mixes with rivers and lakes [13]. The Dukan Reservoir, the largest lake in KRI and the main source of drinking water for Sulaymaniyah governorate, including Sulaymaniyah city, is contaminated with heavy metals to an alarming level [14]. Heavy metals are nonbiodegradable and cause various serious diseases when accumulated in living tissues [15]. The quality of Sulaymaniyah's water has been declining over the past years, and it is expected to decline further owing to the insufficient preventive measures by the local authorities [16]. The Tanjaro River, Qlyasan Stream, and Darbandikhan Reservoir in Sulaymaniyah governorate are some other examples for contamination of surface water with heavy metals. Tanjaro and Qlyasan receive untreated domestic and industrial waste before they join the Darbandikhan Reservoir, which is the second largest lake in KRI and the source of drinking water for hundreds of thousands of people. Abdul Hameed M. et al. [17], Salih Majid et al. [18, 19], and Ahmed Khwakaram [20] say that the water in the reservoir is not safe for people to drink.

The drinking water of the Duhok governorate is another example. It is contaminated and not suitable for drinking. It includes the city of Duhok, the largest urban center in the governorate and the third-largest city in KRI. The city's drinking water comes from the Duhok Dam, which is polluted by socioeconomic activities including agriculture. The water receives some treatment before it is pumped to consumers, but it is still polluted with fecal bacteria [21–23]. It is then sent into the Duhok Valley without any treatment, where it is used for irrigation of fruits and vegetables and to water animals before it reaches the Mosul Dam after a 24-kilometer journey [24]. It is then sent into the Mosul Dam after that.

Groundwater is another main source of both drinking water and irrigation. It is the only source of water in many areas of KRI. This resource can become polluted by agricultural, urban, and industrial wastes that leak into underlying aquifers [25]. KRI groundwater is polluted in some areas by these sources. Sulaymaniyah groundwater, its well-water and karez-water (subterranean water), for example, is not potable because of leakage from sewage and other contaminants. The situation is worse for groundwater in those places that are adjacent to polluted rivers, streams, or sewage outlets [26]. Many places near oil refineries have very dirty groundwater [27].

Another example of groundwater pollution is the groundwater of the Makhmur plain, which is the largest cropland area in the Erbil governorate and has a sizable population. According to one study [28], the water is not safe for people to drink.

Air is being increasingly polluted in KRI, with many health consequences for people [29]. Highly toxic gases and toxic metal elements are being released into the air from industrial activities in general and oil activities in particular (Meena B.I. and Omar K.A. [30]). Toxic gases with heavy metals in the air are also attributed to heavy traffic density in the urban centers and on the roads [5]. Heavy traffic density has also been linked to soil pollution in urban areas [31]. KRI has no tram, train, or underground train. It has a bus service, but it is suited to malls and operates only in limited areas and often without a timetable. Many people rely on their own cars for transportation.

Almost all the existing vehicles in KRI run on gasoline or diesel. This contributes to increasing air pollution. Lead emissions from cars have a high level of lead, a heavy metal. Tetraethyllead is added to gasoline in KRI "to improve its quality and to increase its octane number," but with huge consequences for human health and the environment [32].

Another main source of air pollution is private electricity generators operating in residential neighborhoods. In KRI, consumers generally receive electricity from two sources: national and private. National electricity means the electricity that comes from the state-owned power plants, and private electricity means the electricity that is supplied by privately-owned electricity generators operating in the residential areas. Each generator supplies power to some hundred houses or shops. In KRI, national power is not constant; it often cuts out, especially on cold and hot days when demand for electricity is high. Private generators fill the gap. They supply power, sometimes up to 12 hours a day, and, as a result, release huge amounts of CO2, NOx, SO2,

CO, solid particulates, and CB into the air [33]. Therefore, the generators constitute a major source of air pollution, which, combined with the gases emitted by cars, oil tanker trucks, and factories, often creates a layer of black clouds over the cities [34]. People in positions of power can be made to see the seriousness of the problem and be persuaded to get the public to agree with them [35].

Another serious environmental problem is the overexploitation and overconsumption of natural resources, mainly water. The surface water, which comes from precipitation and international rivers, is not properly harvested. Only a small amount is kept in few lakes, and a lot of it is wasted when it is sent to homes or farms [36, 37].

Groundwater is being seriously overexploited and degraded in KRI. Groundwater is heavily used for drinking and irrigation in most areas in KRI. Digging tools and drilling machines have made it easy for many people to get the tube or artesian wells on their farms or even in their back yards. It is easy to obtain a government license for digging a well, but if it is not obtained, people still dig wells because they know that they can easily get away with it; generally, there are no legal consequences. Moreover, the government is also responsible for degrading the groundwater. It considers that groundwater can easily be accessed to satisfy short-term needs. Consequently, tens of thousands of water wells have been constructed all over the KRI. The excessive withdrawal of their water has markedly lowered the groundwater table. For example, the groundwater in the Erbil province has fallen by half from 2000 to 2015 [38]. This shows that withdrawal has been much higher than recovery and that water has been used in an unsustainable manner [39].

Unsustainable usage of water resources is a serious environmental problem in KRI. There are also some other factors that contribute to the deterioration of water, namely, the climate change factor and controlling the flow of the transboundary rivers by upstream Iran and Turkey. These factors add to the water shortage in KRI. The water security in KRI is at great risk [40–42].

All in all, the environmental problems in KRI are getting worse, and there are no plans by KRG to meet the scale of the problem [43]. In the following section, we study the securitization concept, which has existed since the end of the Cold War. It is held to be useful for tackling nonconventional threats, whether socioeconomic or environmental. We explain the concept and look at its different parts, and we say that the concept needs to be changed to serve a specific purpose in a specific area, like KRI's environmental problems.

2.2. Securitization of Environmental Problems. Securitization can mean different things in different fields. In the legal sector, for example, it means a "transaction or scheme, whereby the credit risk associated with an exposure or pool of exposures is tranche (divided into parts)" [44]. Securitization is the process of turning an issue into a security issue, putting it in the security realm or on the security agenda so that it can be dealt with in a different way [45, 46].

Security was considered to be a matter of international relations. It was understood to be about interstate rivalries; for example, a state perceives an existential threat, usually of a military type, arising beyond its borders; therefore, it has to repel it by all the means at hand [47]. This is the realist approach to security. It is now considered to be a narrow understanding of what constitutes a security issue or what constitutes national security. Securitization of the environment takes a broader view of security than usual, and it is best pursued at the state level. Environmental securitization at the international level does not stand a chance. It boomeranged in the case of the UK's and Netherlands' attempts to securitize climate change [48–50].

Environmental issues were among the nontraditional (socioeconomic) issues to be transformed into the security realm in the second half of the twentieth century [51, 52]. Problems in this sector could no longer be ignored, such as the "loss of biodiversity and habitat degradation of water and soil" [53]. Environmental issues slowly and increasingly gained ground in the second half of the twentieth century as a matter directly related to the sustainability of modern life [54, 55]. In 1987, the United Nations General Assembly called this type of security "environmental security." According to Ruth Noorduyn and Wouter T. de Groot [56], civil society groups began to focus on environmental issues, and this led to a general, revolutionary change in Europe in the late 20th century.

Environmental problems refer to the changes in the Earth's atmosphere, soil, and water, such as air, water, and soil pollution and the degradation of their quality and quantity; excessive use of natural resources; and the consequences of those changes for people and the ecosystem. The KRI presents many such problems. Securitization in this context means framing environmental problems as threats and successfully transforming them into the security agenda, which will in turn "become the hegemonic discourse type in government policy" and call for "policies of exception," according to Olaf Corry [57]. This means that some threats are highlighted over others and that the intellectual and material resources at the disposal of the state will be employed to deal with them [58, 59].

Securitization as a process has four main components: the securitizing actor, the referent subject, the referent object, and the audience. The securitizing actor is the top decision-maker in the country who has an acceptable degree of legitimacy (i.e., discursive legitimacy as there are no universal values for legitimacy) and that person might be supported or convinced by the functional actors or support actors such as NGOs to securitize a threat. The actor makes a convenient speech, called a speech act, which has to be understood in the broader social environment and believed to be effective in dealing with the issue at hand, i.e., with the referent subject, which is portrayed as a threat to the referent object by using security-laden words to convince the audience to accept the new approach. The referent object must also have a legitimate and genuine claim to survival. This can be anything important to the audience, or it can be the audience themselves, as in the case of environmental problems. It is important that the audience must be

convinced that the action the securitizing actor intends to take is necessary to deal with the threat [55, 58–60].

The audience's conviction gives legitimacy to the securitizing actor to go ahead with the proposed action. In the words of Balzac, the greater the audience's persuasion, the greater the ability of the leaders to carry out the securitization process [47]. The conviction element may imply that securitization can truly happen only in democratic systems where the legitimacy of the political leaders comes from the public's consent. This might indicate that securitization is not applicable in nondemocratic political systems where political leaders rule with force and do not need the audience's consent [61]. But this is not very accurate. Leaders of the nondemocratic and totalitarian political systems still seek their people's consent in different ways [62].

In the context of KRI, the securitizing actors are the country's decision-makers; above them is the Prime Minister, who holds the highest office in the land; and the functional actors are the civil society groups, prominent individuals, and the media, which have a significant influence on the country's decision-makers as well as the audience. The referent subjects are the environmental problems we have studied in the previous section. The referent objects are the people who live in KRI, especially those who are most affected by the environmental problems and the environment itself. Considering the environment as a referent object is necessary because the insecurity of an entity will jeopardize the survival of another entity and, consequently, the survival of all. The audience is the people and the country's legislators. The latter is more formal in its support of the securitization move, while the former is more informal in its support. Last but not least, it will require a lot of state resources to deal with the growing environmental problems [47, 52, 53, 59, 63–65].

Here, we need to state that the proposed securitizing actors in KRI are responsible for creating the very threat that they now have to guard against and that the audience is also responsible for creating the threat that they need to be protected from. The referent objects include both the audience and the securitizing actors who need to be protected from the threat. The environment, which is considered to be the source of the threat, is in fact an object to be protected from the threat; it is a victim too [66].

The environmental problems in KRI are material and objective, and they directly affect people. These factors help to make a stronger argument for their securitization [49, 59, 67]. Some experts say that in order for a securitization process to work, there must be real-world factors like material evidence that can be used to make people aware of the size of the threat and how important it is to act quickly.

When securitization is completed and the problems have been dealt with successfully, there can be a reverse process by which the securitized matter would be returned to normal politics, where it will be treated in a manner similar to the treatment of other problems [68]. Because the government cannot spend all of its resources on one thing, like the environment, for very long, this is a step that must be taken. Other things need to be looked at, and the state must be ready to deal with any new problems that come up, so this is a good thing to do.

2.3. Obstacles to Securitization. Environmental securitization in KRI is not only a matter of clarifying and applying the concept theoretically. There are certain obstacles on the ground that hamper the success of the process: the political organization of society and events around the KRI borders as political obstacles, the patron-client economy as an economic obstacle, and the recent history of KRI as a psychological obstacle. Securitization cannot happen successfully as long as these obstacles are present.

The KRI's political organization or political system is created and maintained by two ruling political armed parties. They are the Kurdistan Democratic Party (KDP) and the Patriotic Union of Kurdistan (PUK). Since the end of their civil war in 1998, the KDP has controlled the northern and western parts of Erbil governorate and all of Dohuk governorate, while the PUK has controlled the southern and eastern parts of Erbil governorate and all of Sulaymaniyah and Halabja governorates. The two parties share power in one government, the KRG, but at the same time, they continuously build up more military and intelligence power and control revenue sources for each party in their zone of control. KDP has an upper hand over government affairs because the government cabinet is based in Erbil City, which is in KDP's zone of control. The two parties maintain sizable military, security, and intelligence agencies, and they own dozens of media outlets. The two parties, directly and indirectly, support different political and social groups in return for their loyalty. For KDP and PUK, what matters most of the time is their own power and survival, and they are prepared to do anything in that regard. This means that issues like environmental problems do not matter much to them [50, 69, 70].

The political system of KRI is one of the leading reasons for the neglect of environmental problems. It allows a large portion of the country's revenues to go to the ruling political parties. Members of the ruling parties who occupy high governmental posts are preoccupied with personal gains and their parties' security and survival, and they are less interested in issues that concern the nation as a whole. This has led to a situation where KRG does not get sufficient income to manage its own administrative affairs.

The second political obstacle is events around the KRI borders. KRI is located in a region characterized by intense military security and armed rivalries and conflicts. All of the KRI's neighbors, Iran, Turkey, Syria, and Iraq, are concerned about their security and are engaged in military confrontations with their adversaries near the KRI's borders [71, 72]. Syria fights many rebel groups [73] and Iraq fights remnants of ISIS [74]. This state of affairs has a considerable impact on the decision-making in KRI regarding what problems constitute security threats and what issues should be given the highest attention. In the wider region, there is a lot of support for military security, which makes it less likely that nonmilitary issues will be resolved.

The economic impediment to environmental security is the result of political organization. Over the past three decades, the ruling parties have used the country's resources to buy people's loyalty. The policy they pursued was that both the parties, each in their zone, recruited many people in the public sector while there were no real vacancies for many of them. They also registered many people to receive monthly allowances from the government. Hundreds of thousands of people went on the KRG payroll. Many become "ghost employees," meaning employees without a job or a post but still paid. Besides, some employees receive more than one salary from the government as they are registered with different names or with the same name but in different government departments, and some of those people receive a salary from the government and a salary from the ruling political parties. Furthermore, the ruling parties have salaries or allowances for their own members. Businesses, small and big, are also dependent on the support of the ruling parties [70, 75–77].

In total, more than a million people out of the 6 million people living in KRI are recipients of monthly salaries, pensions, or allowances [78]. This situation is very costly for the government to maintain; sometimes all the national revenues collected in a month are not enough to fully pay all those who are on the government payroll in that month [79]. This is at a time when KRG has a real problem with collecting the national revenues completely because of the division of KRI into two zones of control. Accordingly, with regard to the securitization of the environment, things look bad: there might not be enough financial resources at the government's disposal for environmental problems. Another thing to keep in mind is that the people who get money from the government are not likely to agree to any securitization move that could affect their monthly payments.

The third obstacle to environmental securitization in KRI is psychological. It is the result of many wars and conflicts in the area. The Kurdish liberation movement from the 1940s and the continuing struggle and armed conflicts with the successive Iraqi regimes have turned KRI into a battleground. Besides, the eight-year Iran-Iraq war created further destruction and caused many deaths. The chemical attack on the town of Halabja and the Anfal campaign genocide, which together killed more than 180,000 Kurdish civilians, are two more examples of war and conflict in KRI [9, 80, 81]. People, specifically the elderly generation, are familiar with the sound of gunshots and artillery shelling, and images of war and violence are lodged in their memories. These events, together with the ongoing military conflicts around the KRI borders, have made military threats constant and far and away from the most recognizable kind of threat. The environment is displaced by the attacks on its human residents.

3. Conclusion

Soil, water, and air pollution and water overexploitation in KRI create existential threats to people. This research has argued that these problems need to be solved in an effective and urgent manner. KRI's environmental problems have been growing for quite a long time. They constitute real threats to the lives and wellbeing of people and also to the ecosystem. The solution can best be achieved when these problems are transformed into the realm of security, where life-threatening issues receive the highest attention from the government, i.e., when they are securitized.

Securitization is security in motion. It is security in broad terms to include threats from unconventional sources alongside the military. The military capability of the enemy is no longer counted as the only source of threat to the inhabitants of a country. There are many other threats that are no less dangerous to life or the quality of life than military threats, such as poverty, hunger, deadly diseases, denial of one's ethnic or religious identity, or one's language, culture, tradition, or way of life. These threats are existential in the sense that they threaten the very existence of life or the dignity of the targeted population. Soil, water, and air are the main components of the environment, and when they get bad, they make life less good and it is hard to keep up in the long run.

KRI's environmental problems need an urgent and effective solution. We proposed securitization as a mechanism for that solution and clarified who should do it and how. We proposed that the securitizing actor be the country's top decision-makers, most importantly the Prime Minister of KRG; the functional actors, those who initiate and/or support the securitization act, to be the civil society groups, media outlets, and prominent individuals; the environmental problems to be designated as the referent subject; and the referent object to be the people living in KRI who should be freed from the problems. The people are also the audience who, through their representatives in the parliament but also the media and other outlets, give their consent or rejection to a proposed securitization act [82]. We rationalized that the securitizing actors are at the same time referent objects in the sense that they are affected by environmental problems. We say that the people who now need to be protected are themselves a threat to the environment. This is because most modern environmental problems are caused by people being careless with the environment and misusing its resources.

Environmental securitization carries the promise of solving the KRI environmental problems in an urgent and effective manner. The process can begin now and the roles can be distributed as we have proposed above, but it will not be successful unless several main obstacles on the ground are removed: political, economic, and psychological. In other words, these obstacles need to be treated first. The political obstacle is related to the political organization of KRI and also to the security situation in the border areas. The political organization allows the ruling parties, KDP and PUK, to pursue narrow party interests, prolong the division of KRI into two zones, and use the national revenues for their own benefits. This means that power struggles, party security, and interests take precedence, while other issues are pushed to the sidelines. The economic obstacle is the result of the KRI clientele economy, whereby the national revenues largely go to the ruling parties and the government employees and allowance receivers. This means that fewer financial resources are available for environmental securitization.

Lastly, the situation near the KRI borders and the people's memory of war and conflict affect the way people classify threats.

For the securitization of environmental problems to happen in KRI, the speech act, which is considered the first step, must be preceded by significant political, economic, and psychological improvements; the improvement of the political and economic systems; and efforts to be made to minimize the effects of war on people's minds. This is mainly the task of the securitizing and functional actors. Securitization is, of necessity, a long and unpredictable process [83–88].

Data Availability

Data are available upon request.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

References

[1] Niqash (undated) In Kurdish, "Capital of culture the art must go on," 2021, https://www.niqash.org/en/articles/society/5277/.

[2] The Iraqi Constitution. Retrieved from the official website of the Ministry of Natural Resources of Kurdistan Regional Government at: https://mnr.krg.org/index.php/en/the-ministry/legal-framework/laws.

[3] D. McDowell, *A Modern History of the Kurds*, Bloomsbury Publishing, London, UK, 2003.

[4] G. de Ville, "Climate change – bad news for environmental security," *Environmental Law Review*, vol. 10, no. 3, pp. 175–180, 2008.

[5] A. M. Amin, "Kurdistan oil and its impact on Kurdistan environment -overview," in *Proceedings of the 2017 International Conference on Environmental Impacts of the Oil and Gas Industries: Kurdistan Region of Iraq as a Case Study (EIOGI)*, Koya-Erbil, Iraq, April 2017.

[6] S. Khudhur and N. Khudhur, "Soil pollution assessment from industrial area of Erbil city," *Journal of Zankoi Sulaimani*, vol. 17, 2015.

[7] M. Q. Saleh, Z. A. Hamad, and J. R. Hama, "Assessment of some heavy metals in crude oil workers from Kurdistan Region, Northern Iraq," *Environmental Monitoring and Assessment*, vol. 193, no. 1, p. 49, 2021.

[8] K. Saber, "Oil refineries in Kurdistan: a study of their environmental impact on, humans and their livelihood," *International Journal of Law*, vol. 6, no. 3, pp. 173–177, 2020.

[9] Rudaw (2020), https://www.rudaw.net/sorani/business/170820206, 2020.

[10] K. A. M. Hawrami, N. M. J. Crout, G. Shaw, and E. H. Bailey, "Assessment of potentially toxic elements in vegetables cultivated in Urban and peri-Urban sites in the Kurdistan Region of Iraq and implications for human health," *Environmental Geochemistry and Health*, vol. 42, pp. 1359–1385, 2020.

[11] C. Rashid, J. Tahir, and O. Mustafa, "Solid waste management: a case study in Chamchamal (Dwbra Valley open dump), Sulaimani, Kurdistan Region," in *Proceedings of the 2nd International Conference of Natural Science 2017*, Sulaimani, Iraq, September 2018.

[12] S. Q. S. Gardi, "2D electrical resistivity tomography survey for Shallow environmental study at waste water Valley of Southwestern Erbil city, Iraqi Kurdistan Region," *Research Journal of Environmental and Earth Sciences*, vol. 6, no. 5, pp. 266–277, 2014.

[13] A. Amin, "Evaluation of wastewater characteristics in the Urban area of Sulaymaniyah governorate in Kurdistan-Iraq," in *Proceedings of the 4th International Engineering Conference on Developments in Civil & Computer Engineering Applications*, Erbil, Iraq, 2018.

[14] B. H. Marouf, "Association between serum heavy metals level and cancer incidence in Darbandikhan and Kalar areas, Kurdistan Region, Iraq," *Nigerian Journal of Clinical Practice*, vol. 21, no. 6, 2018.

[15] A. Ahmad and K. Barzinji, "Evaluation of hazardous and metal pollution indices of rivers that supply Dukan Reservoir, Kurdistan, Northeast Iraq," *Plant Archives*, vol. 20, no. Supplement 1, pp. 2453–2466, 2020.

[16] R. Rasheed and U. Aziz, "Evaluation of some heavy metals in well water within Sulaimani city, Kurdistan Region-Iraq," *Marsh Bulletin*, vol. 8, no. 2, pp. 131–147, 2013.

[17] M. Abdul Hameed, A. H. M. Jawad Al Obaidy, H. Abid, and B. K. Maulood, "Application of water quality index for assessment of Dokan Lake ecosystem, Kurdistan Region, Iraq," *Journal of Water Resource and Protection*, vol. 2, no. 9, 2010.

[18] D. Ahmed and T. Farkha, "Phycolimnological study of some wastewater of Sulaimani Provience -Kurdistan Region of Iraq," *Journal of Zankoy Sulaimani JZS-A*, vol. 22, no. 2, 2020.

[19] S. Majid, A. I. Khwakaram, and H. Khaled Gado, "Pollution status evaluation of some heavy metals along some surface water sources by multivariate data analysis at Sulaimani governorate," *Journal of Zankoy Sulaimani*, vol. 20, 2018.

[20] K. Ahmed, "Effects of fat, oil and grease (FOG) discharge pollutants on water quality of Qalyasan Stream, Tanjaro River and impact of fat, oil and grease on Darbandikhan Reservoir in Sulaimani City – Kurdistan Region of Iraq – Iraq," *International Journal of Environment, Ecology, Family and Urban Studies*, vol. 6, no. 1, 2016.

[21] B. Dana and D. Ganjo, "Water pollution, limnological investigations in Kurdistan Region and other parts of Iraq," *International Journal of Science, Environment and Technology*, vol. 3, no. 3, pp. 776–799, 2014.

[22] K. Hawrami and M. Hassan, "Assessing risks to human health from potentially toxic elements in drinking water of Duhok Province/Kurdistan Region of Iraq," *Journal of Environment Pollution and Human Health*, vol. 2, no. 2, pp. 44–51, 2014.

[23] N. I. Mohammed and K. A. Bamarni, "Water quality monitoring of Duhok Dam (Kurdistan Region of Iraq)," *ZANCO Journal of Pure and Applied Sciences*, vol. 31, no. 1, pp. 7–16, 2019.

[24] H. Al-mezori and K. A. M. Hawrami, "Evaluation of microbial quality of the drinking water of Duhok Province/Kurdistan Region of Iraq," in *Proceedings of the 2011 2nd International Conference on Environmental Science and Development IPCBEE*, IACSIT Press, Singapore, 2011.

[25] N. Hassan and M. R. Ahmed Al-barware, "Assessment of wastewater in Duhok Valley, Kurdistan Region/Iraq," *Advances in Science, Technology and Engineering Systems Journal*, vol. 1, no. 3, pp. 7–13, 2016.

[26] H. Al-Sudani, "A review on groundwater pollution," *International Journal of Recent Engineering Science*, vol. 6, no. 5, 2019.

[27] O. Mustafa and H. Ahmad, "Nitrate pollution in groundwater of Sulaymaniyah city, Kurdistan Region, NE Iraq," *Iraqi Bulletin of Geology and Mining*, vol. 4, no. 2, pp. 73–82, 2008.

[28] D. A. M. Amin Al Manmi, T. O. Abdullah, P. M. Al-Jaf, and N. Al-Ansari, "Soil and groundwater pollution assessment and delineation of intensity risk map in Sulaymaniyah City, NE of Iraq," *Water*, vol. 11, no. 10, p. 2158, 2019.

[29] L. Al-Naqishbandi, J. Toma, and B. K. Mauloud, "A study on water quality in Makhmur area, Kurdistan, Iraq," *ZANCO Journal of Pure and Applied Sciences (ZJPAS)*, vol. 20, no. 2, 2008.

[30] B. I. Meena and K. A. Omar, "Chemical analysis of rainwater and study effect of vehicle emissions on human health in Kurdistan Region," *Original Journal of Chemistry*, vol. 31, no. 2, pp. 689–695, 2015.

[31] G. Y. Haji, D. J. Mustafa, S. Youssef, N. A. Karim, and M. Y. Fatah, "Mapping heavy metals pollution in Urban area by using Gis techniques in Duhok governorate, Kurdistan Region of Iraq," *Journal of University of Duhok*, vol. 23, no. 1, pp. 51–64, 2020.

[32] K. Amjadian, E. Sacchi, and M. Rastegari Mehr, "Heavy metals (HMs) and polycyclic aromatic hydrocarbons (PAHs) in soils of different land uses in Erbil metropolis, Kurdistan Region, Iraq," *Environmental Monitoring and Assessment*, vol. 188, no. 11, p. 605, 2016.

[33] H. M. Jassim, "Lead pollution in Iraqi Kurdistan Region," *International Journal of Engineering Trends and Technology (IJETT)*, vol. 4, no. 6, 2013.

[34] H. H. Abbas, F. H. Ibraheem, and A. A. Maaroof, "Pollution problems in Koya City due to private electrical generators," *Aro-The Scientific Journal of Koya University*, vol. 7, no. 2, 2019.

[35] S. Farhan and H. A. Anjel, "Air pollution estimation in Erbil city centre using box mathematical model," in *Proceedings of the 3rd International Conference on Recent Innovations in Engineering (ICRIE)*, Duhok Iraq, September 2020.

[36] L. Hansen, "Theorizing the image for security studies," *European Journal of International Relations*, vol. 17, no. 1, pp. 51–74, 2011.

[37] S. A. Abdulrahman, "Water shortage in Iraq's Kurdistan Region: problems with Iran and possible solutions," *The Middle East Journal*, vol. 74, no. 3, pp. 451–460, 2020.

[38] A. Tinti, "Policy report: water resources management in the Kurdistan Region of Iraq," 2017, https://auis.edu.krd/iris/sites/default/files/Water%20Policy%20Report%20IRIS_FINAL%20ES.pdf.

[39] M. Nanekely, M. Scholz, and S. Q. Aziz, "Towards sustainable management of groundwater: a case study of Semiarid area, Iraqi Kurdistan Region," *European Water*, vol. 57, pp. 451–457, 2017.

[40] O. Bengio, *The Kurds in a Volatile Middle East*, The Begin-Sadat Center for Strategic Studies, Ramat Gan, Israel, 2017.

[41] S. Abdulrahman, "The drying up of the lower Zab River and future water disputes between Iran, Kurdistan Region and Iraq," *International Journal of Environmental Studies*, vol. 76, no. 4, pp. 714–719, 2017.

[42] S. A. Abdulrahman, "Water use practice and water law in the Kurdistan Region: how can sustainability be achieved?" *Environmental Policy and Law*, vol. 51, no. 3, pp. 185–195, 2021.

[43] H. Hameed, "Water harvesting in Erbil governorate, Kurdistan Region, Iraq detection of suitable sites using geographic information system and remote sensing," Master dissertation, Lund University, Lund, Sweden, 2013.

[44] M. K. R. Hassan, "Urban environmental problems in cities of the Kurdistan Region in Iraq," *Local Environment*, vol. 15, no. 1, pp. 59–72, 2010.

[45] H. Patomäki, "Absenting the absence of future dangers and structural transformations in securitization theory," *International Relations*, vol. 29, no. 1, pp. 128–136, 2015.

[46] Thomson Reuters Practical Law, 2020, https://uk.practicallaw.thomsonreuters.com/3-107-7233?transitionType=Default&contextData=(sc.Default)&firstPage=true Available at:.

[47] J. Vaughn, "The unlikely securitizer: humanitarian organizations and the securitization of indistinctiveness," *Security Dialogue*, vol. 40, no. 3, 2009.

[48] C. F. Ronnfeldt, "Review essay: three generations of environment and security research," *Journal of Peace Research*, vol. 34, no. 4, pp. 473–482, 1997.

[49] J. Warner and I. Boas, "Securitization of climate change: how invoking global dangers for instrumental ends can backfire," *Environment and Planning C: Politics and Space*, vol. 37, no. 8, pp. 1471–1488, 2019.

[50] P. Roe, "Securitization and minority rights: conditions of desecuritization," *Security Dialogue*, vol. 35, no. 3, pp. 279–294, 2004.

[51] B. Barry, O. Waever, and J. de Wilde, *Security: A New Framework for Analysis*, Lynne Rienner Publishers, Boulder, CO, USA, 1998.

[52] O. Christou and C. Adamides, "Energy securitization and desecuritization in the New Middle East," *Security Dialogue*, vol. 44, no. 5-6, pp. 507–522, 2013.

[53] J. Joseph, "Exploring the agency-structure dynamics in state-society relations in contemporary China: the case of securitisation of the environmental sector," *China Report*, vol. 56, no. 2, pp. 182–203, 2020.

[54] B. R. Allenby, "Environmental security: concept and implementation," *International Political Science Review*, vol. 21, no. 1, pp. 5–21, 2020.

[55] M. Tennberg, "Risky business: defining the concept of environmental security," *Cooperation and Conflict*, vol. 30, no. 3, pp. 239–258, 1995.

[56] R. E. Noorduyn and W. T. de Groot, "Environment and security: improving the interaction of two science fields," *The Journal of Environment & Development*, vol. 8, no. 1, pp. 24–48, 1999.

[57] O. Corry, "The green legacy of 1989: revolutions, environmentalism and the global age," *Political Studies*, vol. 62, no. 2, pp. 309–325, 2014.

[58] S. J. Baele and O. C. Sterck, "Diagnosing the securitisation of immigration at the EU level: a new method for stronger empirical claims," *Political Studies*, vol. 63, no. 5, pp. 1120–1139, 2015.

[59] T. Balzacq, S. Léonard, and J. Ruzicka, ""Securitization" revisited: theory and cases," *International Relations*, vol. 30, no. 4, pp. 494–531, 2016.

[60] R. G. McGillivray and C. Belli, "Fear, Rhetoric and Securitization of the War in Iraq," 2006, https://rgmcgillivray.com/images/Casus_Belli.pdf.

[61] R. Olesker, "The securitisation dilemma: legitimacy in securitisation studies, critical studies on security," *Critical Studies on Security*, vol. 6, no. 3, pp. 312–329, 2018.

[62] J. A. Vuori, "Illocutionary logic and strands of securitization: applying the theory of securitization to the study of non-democratic political orders," *European Journal of International Relations*, vol. 14, no. 1, pp. 65–99, 2008.

Hindawi
Journal of Environmental and Public Health
Volume 2023, Article ID 9849648, 1 page
https://doi.org/10.1155/2023/9849648

Retraction

Retracted: Economic Growth Effect of Public Health Investment and Its Impact on Living Environment

Journal of Environmental and Public Health

Received 15 November 2022; Accepted 15 November 2022; Published 30 January 2023

Journal of Environmental and Public Health has retracted the article titled "Economic Growth Effect of Public Health Investment and Its Impact on Living Environment" [1] due to concerns that the peer review process has been compromised.

Following an investigation conducted by the Hindawi Research Integrity team [2], significant concerns were identified with the peer reviewers assigned to this article; the investigation has concluded that the peer review process was compromised. We therefore can no longer trust the peer review process, and the article is being retracted with the agreement of the Chief Editor.

References

[1] J. Meng, "Economic Growth Effect of Public Health Investment and Its Impact on Living Environment," *Journal of Environmental and Public Health*, vol. 2022, Article ID 2192255, 7 pages, 2022.

[2] L. Ferguson, "Advancing Research Integrity Collaboratively and with Vigour," 2022, https://www.hindawi.com/post/advancing-research-integrity-collaboratively-and-vigour/.

Hindawi
Journal of Environmental and Public Health
Volume 2022, Article ID 2192255, 7 pages
https://doi.org/10.1155/2022/2192255

Research Article

Economic Growth Effect of Public Health Investment and Its Impact on Living Environment

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Received 6 April 2022; Revised 14 April 2022; Accepted 3 May 2022; Published 26 May 2022

Academic Editor: Sivakumar Pandian

Based on the concern of Chinese residents for health and the improvement of related service demand, this paper studies the economic growth effect of public health investment and its impact on living environment by analyzing the determination coefficient estimated by Spearman and nonlinear curve. The results show that the impact of increasing government financial public health investment on regional economic growth rate is not only related to regional economic aggregate and development level, but also related to regional education level and regional publicity level in logical analysis. The improvement of residents' living environment brought by public infrastructure investment can effectively stimulate residents' concept of health consumption and then make the economy of nonpublic health undertakings achieve a higher growth rate. The economic growth rate brought by nonpublic health undertakings is also an important component of the local economic growth rate. It can be seen that strengthening the infrastructure construction of urban living environment can not only improve the overall living environment quality of the city, but also promote the development of the city and the development speed of the city.

1. Introduction

With the improvement of China's economic level, the living materials of residents have been greatly enriched. With this, residents pay more and more attention to health, and their demand for health-related services has gradually increased. After a highly civilized society, health not only refers to physical diseases and the performance of qualitative strength, but also includes psychology and the ability to adapt to society. Public health investment is the economic cost of counseling to maintain residents' physical and mental health and social adaptability. Health investment is a project beneficial to the public. It is mainly to enable the public to have a healthy physical and mental health and a better and happy life, especially after social progress, and after people's demand for spirit and material increases, people's life pressure increases. Subhealth and psychological problems perplex the young generation. It leads to some negative phenomena in the process of work, life, and study of the young generation, which affects the benign development of the social environment.

People or animals living on the Earth depend on the natural environment to survive (Jing Zhongping (2021)). The living environment is closely related to the living conditions of people or animals. Especially with the progress of science and technology, in order to pursue a more comfortable living environment, people use artificial intelligence to intervene in the surrounding environment and create a good living environment by adjusting the temperature, lighting, and ventilation of the environment. It is beneficial to improve the milk production efficiency of dairy cows [1]. Due to geographical and cultural differences, people's living habits and diet are different, and the personalities of people in the South and the North are quite different (Zhang Jiawei (2021)). When there are relevant data sheets, the probability of cardiovascular disease in patients in northern China is higher than that in the south. However, there is no targeted solution for this phenomenon, which can only be attributed to the impact of the living environment on people's habits, resulting in some negative effects [2]. After the improvement of living standards, people's material pursuit will shift to spiritual satisfaction, and they will also

focus on their own health management (Qian Xiangli (2021)). Through the analysis of the relationship between public health investment and personal health management investment in Jiangsu Province, it is found that public health investment will positively affect the investment in personal health management, while the investment in personal health management has little impact on public health investment. Through the in-depth study of the relationship between them, it is helpful for the state to adopt corresponding strategies for health investment [3]. Zhang Fen (2017) compared the impact of public health investment and private health investment on economic growth. The results show that health investment can significantly promote economic growth, but there is a crowding out effect between them, and the proportion of public health investment varies according to different regions [4].

Everyone needs a healthy physique, so everyone needs to participate in health investment, and building a healthy country needs the comprehensive quality of national health. At the same time, individuals and families need health protection to realize a happy life. Therefore, health is not only a social responsibility, but also an individual's behavior. This study mainly starts from the regional direction to study the effect of public health investment on economic growth and the living environment.

2. Related Concepts and Literature Review

2.1. Public Health and Public Health Investment. The public health of residents plays a vital role in the development and progress of society. Only when the personal health level meets the requirements can we wholeheartedly provide assistance for the development of society. This also affects the intensity of public health investment. Public health investment is mainly aimed at the investment of the state, the government, and social public departments in social medical care that can ensure the health of residents. Public health investment has a positive impact and role in promoting the development of national health and medical and health undertakings, improving the overall health quality of citizens and promoting the harmonious development of society. Yao Yanan's research (2018) shows that public health is closely related to the development of urban green space, so it is necessary to explore and study the correlation between them [5], and green space can also be designed according to the influence mechanism, so as to promote the development of public health. Li Jingwei (2020) studied the correlation between land use and public health and systematically combed the impact of land use on public health through literature analysis [6]. It can also be proved that the use of land can have an impact on the surrounding environmental quality, thus affecting public health.

For personal health, the base of public health is large, and public health is an important part of human capital, and public health investment is an effective way to improve public health. With the attention of society and individuals on public health, the intensity of public health investment will increase [7]. It is emphasized that the public health system should adapt to and promote the construction of economic, political, cultural, social, and ecological civilization of the country (region) where it is located Li Chengyue et al. (2021) [8]. Public health investment can help people obtain the means of living, medical and health services, and resources and time needed for good health. Establishing and improving the basic social health security mechanism is the embodiment of the good development of the country and society, as well as the embodiment of political civilization, material civilization, and spiritual civilization.

2.2. Healthy Economy and Regional Economy. Through the statistical analysis of the national, local, financial, medical, and health expenditure, the whole country is divided into four regions according to the orientation: the east, the middle, the southwest, and the northeast, and the health economy and regional economy of these four regions are analyzed, respectively. The proportion of public health investment in the four regions is in the southwest from large to small [9]. East, central, and northeast: There are two reasons for the differences: one is the inclination and implementation of the government's policies in various regions; second, the economic development of the region itself is different. The geographical location of the eastern region is dominant, and the surrounding resources and technology will drive the local economic development. The data in Table 1 below show the financial public health expenditure in different regions from 2014 to 2019 according to the National Bureau of Statistics.

It can be seen from the data in Table 1 that the financial medical and health expenditure in all regions increases year by year, but the growth trend is different. The state's expenditure on medical and health care has also improved residents' attention to their own health awareness. The better the health status of residents, the better their living conditions, and living standards will be further improved. Therefore, while effectively improving the health level of residents, the regional economy will also be vigorously developed, providing a strong guarantee for people's life.

2.3. Living Environment and Quality of Life. People's living environment will not only have an impact on the local economy, but also have the most direct impact on people's pursuit of quality of life. Having a good living environment can enhance residents' love for life and will not muddle along, which will indirectly improve residents' quality of life. Qiu Jiahong (2021) studied the living environment of the mixing town and found that the natural combination of "arbor, shrub, and grass" is reasonable, so the living environment is better [10]. The living environment also plays a vital role in education. Wang Tingyu (2020) showed the importance of the living environment for early childhood education. A good living environment provides possibilities for early childhood education and also affects the educational content and quality because life materials are the best educational content [11].

Table 1: Financial health expenditure in different regions of the country.

Region	2014	2015	2016	2017	2018	2019
Whole country	10086.56	11868.69	13067.61	14343.05	15412.93	16417.6
East	3953.71	4610.42	5191.12	5685.58	6194.64	6691.63
Central section	2434.06	2901.83	3132.88	3449	3703.35	3935.21
Southwest	2983.43	3554.71	3882.12	4295.45	4582.1	4830.11
Northeast	715.36	801.73	861.49	913.02	932.84	960.65

Data source: annual data of the National Bureau of Statistics from 2014 to 2019.

3. Correlation Analysis of Regional Characteristic Economy

3.1. Spearman Correlation. Spearman correlation algorithm:

$$\rho_s = \frac{\sum_{i=1}^{N}(R_i - \overline{R})(S_i - \overline{S})}{\left[\sum_{i=1}^{N}(R_i - \overline{R})^2 \sum_{i=1}^{N}(S_I - \overline{S})^2\right]^{1/2}}. \quad (1)$$

Here, R_i and S_i are the grades of the observed values, respectively; $\overline{R}$ and $\overline{S}$ are the average grades of variables x and y, respectively; and N is the total number of observations.

3.2. Determination Coefficient of Curve Estimation. Coefficient of determination R2:

$$R^2 = \frac{\sum_i (x_i - \overline{x})}{\sum_i (x_i - \overline{x_i})}, \ \overline{x} = \frac{1}{n}\sum_{i=1}^{n} x_i. \quad (2)$$

Here, $\overline{x}$ is to investigate the arithmetic mean of sample sequence $\widetilde{x}_i$ is the ith input value in the sequence and n is the number of investigation samples.

3.3. Data Sources. Six cities are selected in the eastern region, including Xuzhou, Wuxi, and Changzhou in Jiangsu, Ningbo and Haining in Zhejiang, and Xiamen in Fujian. Six cities are selected in the central region, including Nanyang, Xuchang and Pingdingshan in Henan, Xiangfan and Huanggang in Hubei, and Yuncheng in Shanxi. Six cities are selected in Southwest China, including Kunming, Tengchong, and Pu'er in Yunnan, Baise, Beihai, and Liuzhou in Guangxi. Six cities were selected in Northeast China, including Anshan and Dandong in Liaoning, Tonghua and Baicheng in Jilin, and Hegang and Mudanjiang in Heilongjiang. The selection range of cities excludes provincial capital cities and other subprovincial cities, and the urban data are closer to the regional median. The specific data come from the provincial and municipal statistical yearbook data, government report data, Industry Association Statistics, etc.

4. Correlation between Economic Growth and Health Investment

In this model, the proportion of public health investment and residents' personal health consumption are used as the correlation coefficient of health investment. Among them, the proportion of public health investment refers to the proportion of the investment of finance, SASAC, and nonpublic investors in hospitals, health service places, and urban health facilities in the total investment of the city in the current year. The proportion of residents' personal health consumption refers to the proportion of health-related consumption in residents' disposable income, including but not limited to health examination, nutrition and health care, health consultation, and other fields. The proportion of government public health investment in total fiscal revenue is selected as the independent variable data in the model. Through statistical data analysis, it can be seen that the data of Southwest China are higher than those of other regions, and the economy of central China and Northeast China is also lower than that of eastern China. Therefore, increasing regional public health investment plays a good role in promoting local economic development.

Firstly, the curve estimation calculation of 11 linear and nonlinear functions is performed for the above data, and the highest R2 value in all functions is selected as the regression determination coefficient. Spearman correlation analysis is performed for two independent variables (the proportion of public health investment and the proportion of residents' personal health consumption) and one dependent variable (the year-on-year growth rate of regional economy), and the highest R2 value is selected ρ Value as the result of correlation analysis. The results obtained by the above statistical methods are shown in Table 2.

In Table 2, it was found that the determination coefficient of all four groups of cities was $R^2 > 0.800$, $P < 0.01$. The correlation results of 0.900, $P < 0.01$, show that the data of four groups of cities have significant correlation and coupling. We have to investigate the distribution law of two independent variables (the proportion of public health investment and the proportion of residents' personal health consumption), respectively, perform data visualization, and get Figures 1 and 2.

In Figure 1, the data expression of Southwest China is significantly higher than that of other regions. Only from the analysis of these data, the data sensitivity of economically relatively backward regions is higher, but the economy of central and Northeast China is also lower than that of eastern regions, and its data expression is lower than that of eastern regions. Therefore, the impact of increasing government financial public health investment on the regional economic growth rate is not only related to the regional economic aggregate and development level, but also related to the regional education level and regional publicity level in terms of logical analysis. The two data in Figure 1 are expressed as follows: (1) The economic development power of Southwest China is more sensitive to regional public health investment. (2) Increasing regional public health

Table 2: Correlation analysis results of original data of four groups of cities (economic growth and health investment).

Grouping	Coefficient of determination		Relevance	
	R^2	P	ρ	P
East	0.905	0.006	0.913	0.005
Central section	0.867	0.005	0.924	0.006
Southwest	0.835	0.007	0.905	0.005
Northeast	0.855	0.004	0.915	0.007

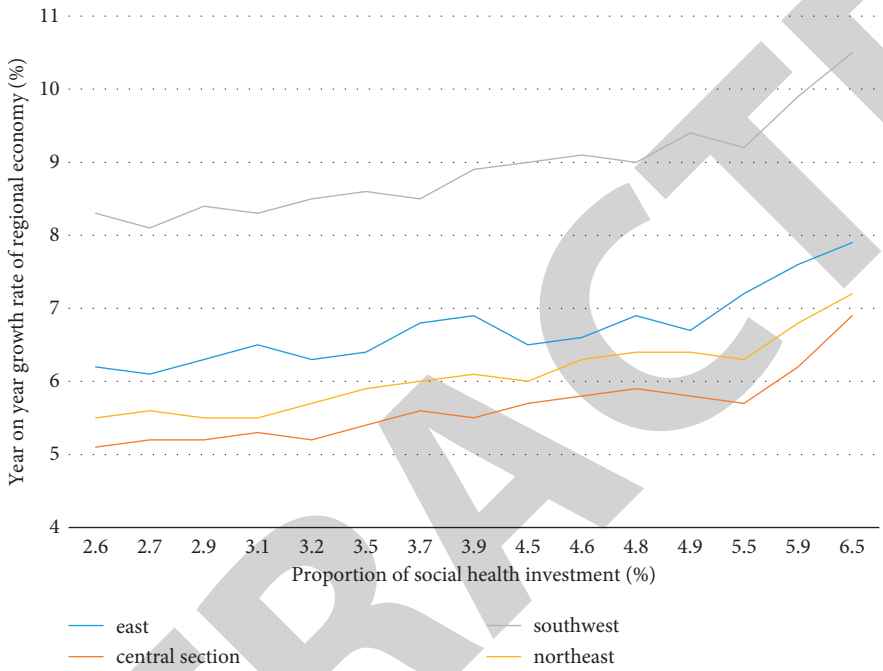

Figure 1: Relationship curve between the proportion of public health investment and the year-on-year growth rate of regional economy.

investment shows an upward trend in all four groups of cities; that is, increasing regional public health investment in any city can promote local economic development.

In Figure 2, the sensitivity of data in Southwest China is still the highest, followed by the eastern region, northeast region, and central region. The data expression is basically consistent with the data expression in Figure 1 given above. It can be considered that in the investment consumption, "two carriages" theory, the impact logic of personal health consumption, and public health investment on regional economy are completely consistent. Residents' attention to health investment can improve people's ability to resist diseases and promote the benign interaction among individuals, society, and economy. A healthy labor force is promoted by health investment, so as to better promote economic growth.

5. Correlation between Living Environment and Health Investment

In the previous paper, two independent variables were used to conduct correlation analysis on the year-on-year growth of regional economy. The model goes further and restricts the urban living environment with public infrastructure investment (including but not limited to public health investment), that is, assuming that the living environment of urban residents with better urban infrastructure is better, two dependent variables are set in the model, which are the proportion of residents' health consumption and the economic growth rate brought by health investment of non-public economy. For the above data, we need to expand the curve estimation algorithm based on 11 curve functions, take the maximum determination coefficient R2, and expand Spearman correlation analysis to take the maximum ρ. The analysis results are shown in Table 3.

In Table 3, among all four groups of cities, the eastern city has the highest R2 value, but the northeast city has the Spearman correlation ρ; that is, the data expression of the four groups of cities is more similar. All four groups of cities had the result of $R2 > 0.800$, $P < 0.01$ $\rho>$. The correlation results of 0.900, $P < 0.01$, show that the data of four groups of cities have significant correlation and coupling. Two dependent variables (the proportion of residents' health consumption and the economic growth rate brought by health undertakings invested by non-public economy) were investigated, respectively, and the data visual analysis was carried out. The analysis results are shown in Figures 3 and 4.

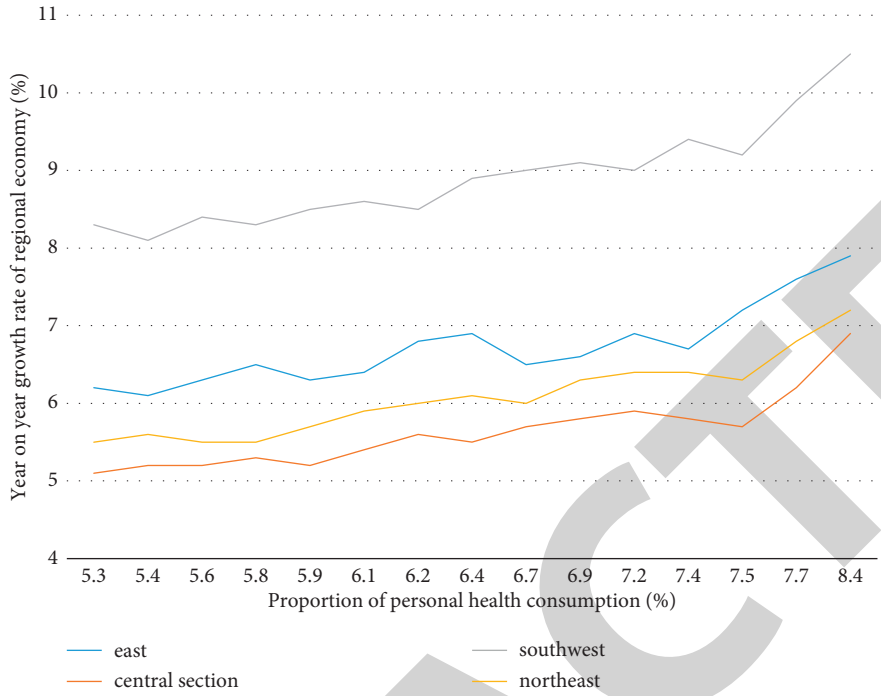

Figure 2: Relationship curve between the proportion of personal health consumption and the year-on-year growth rate of regional economy.

Table 3: Correlation analysis results of original data of four groups of cities (living environment and health investment).

Grouping	Coefficient of determination		Relevance	
	R^2	P	ρ	P
East	0.913	0.006	0.927	0.004
Central section	0.824	0.008	0.914	0.006
Southwest	0.847	0.007	0.892	0.005
Northeast	0.875	0.004	0.935	0.004

In Figure 3, in terms of data sensitivity, the eastern region is the highest, followed by the northeast, and central and southwest regions. In the current situation investigation, the distribution law of the curve is related to the integrity of the previous urban infrastructure. That is, cities with a higher degree of infrastructure completion continue to increase urban infrastructure investment, which will give greater impetus to residents' health consumption. At the same time, when the infrastructure investment of the four groups of cities accounts for more than 10% of the total financial expenditure, the proportion of residents' health consumption will have a steep rising edge, which is more significant in the data expression of eastern cities. That is, from the philosophical theory of qualitative change caused by quantitative change, the proportion of urban public infrastructure investment should reach more than 10%, so as to effectively stimulate residents' healthy consumption and achieve higher investment efficiency.

In Figure 4, in terms of data sensitivity, the eastern region is the highest, the central region is the second, the northeast and southwest regions have the lowest data expression, and the curve trend is almost the same. This data rule is basically consistent with the data rule of public infrastructure investment and residents' health consumption rate in Figure 3. Through the joint observation of the data in Figures 3 and 4, we can get the following data characteristics: ① the improvement of residents' living environment brought by public infrastructure investment can effectively stimulate residents' concept of health consumption, so as to achieve a higher growth rate of nonpublic health industry economy; ② the economic growth rate brought by nonpublic health undertakings is also an important component of the local economic growth rate. Relevant studies show that increasing the infrastructure construction of the urban living environment is also of positive significance to the growth rate of other economic forms.

6. Strategies and Suggestions for Improving Residents' Living Environment

6.1. Cities Should Appropriately Strengthen Constructive Investment in Public Health. In the four groups of 24 cities involved in the study, increasing the amount of financial investment in public health can effectively stimulate the concept of health consumption of local residents, healthy

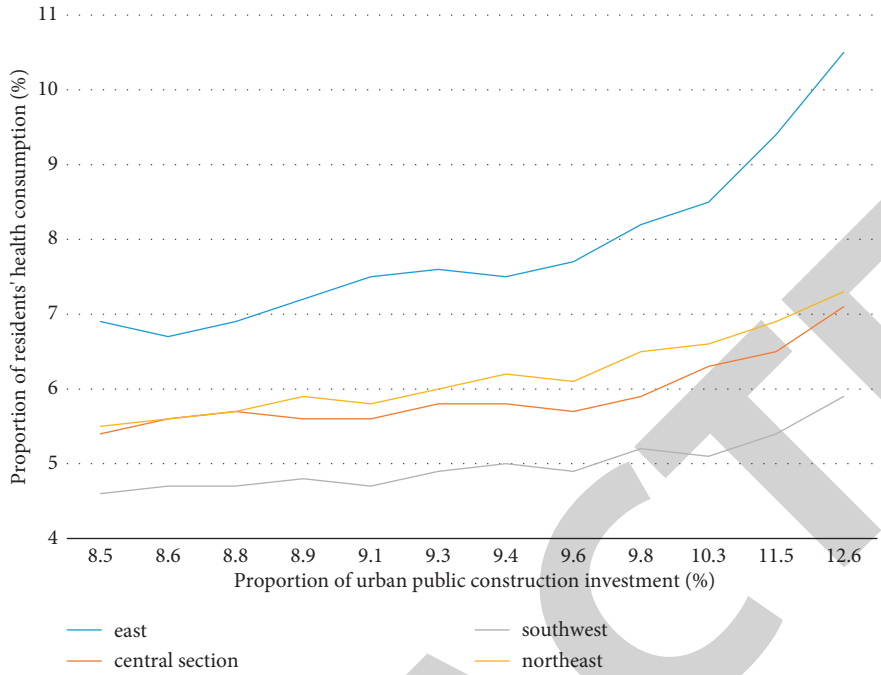

Figure 3: Correlation curve between public infrastructure investment and residents' health consumption rate.

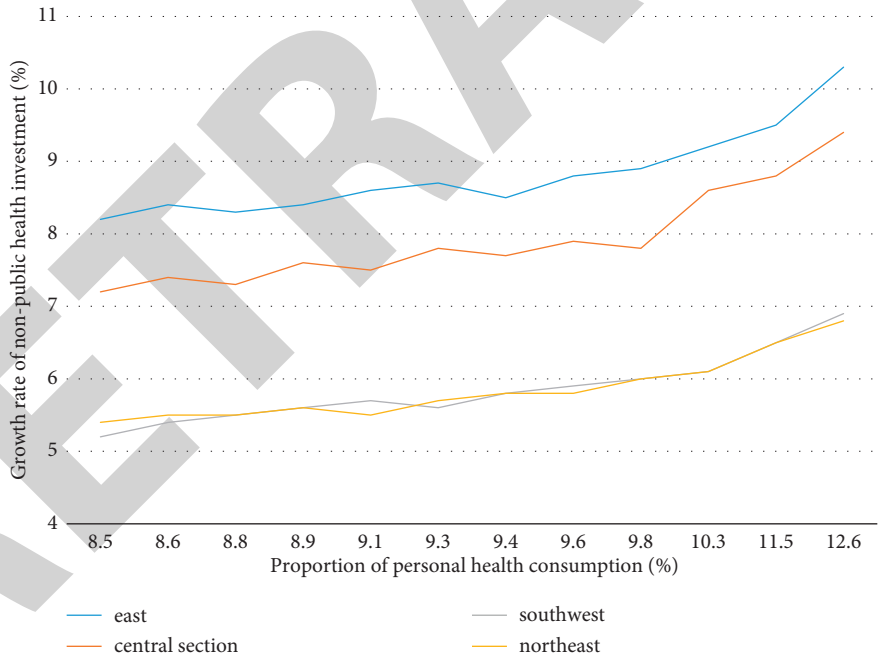

Figure 4: Correlation curve between public infrastructure investment and the growth rate of nonpublic health undertakings.

individuals improve the level of healthy labor force, improve the employment opportunities of workers, and realize the income of their health investment, so as to further stimulate the growth of local economy. It can be considered that any city should focus on public health investment in infrastructure investment. However, in the investment of urban infrastructure, we should not be too inclined to the investment in the field of public health. In the above research, improving the level of urban public infrastructure can also achieve the corresponding pulling effect. If we unilaterally strengthen the investment in public construction in the field of health, it will directly affect other urban public functions, such as urban public transport, municipal roads, municipal water supply, and drainage. That is, a certain proportion of urban infrastructure investment in public construction in the field of health should be maintained to ensure that the urban environment is scientifically optimized [12].

Hindawi
Journal of Environmental and Public Health
Volume 2023, Article ID 9792879, 1 page
https://doi.org/10.1155/2023/9792879

Retraction

Retracted: Treatment of Pharma Effluent using Anaerobic Packed Bed Reactor

Journal of Environmental and Public Health

Received 27 June 2023; Accepted 27 June 2023; Published 28 June 2023

This article has been retracted by Hindawi following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of one or more of the following indicators of systematic manipulation of the publication process:

(1) Discrepancies in scope

(2) Discrepancies in the description of the research reported

(3) Discrepancies between the availability of data and the research described

(4) Inappropriate citations

(5) Incoherent, meaningless and/or irrelevant content included in the article

(6) Peer-review manipulation

The presence of these indicators undermines our confidence in the integrity of the article's content and we cannot, therefore, vouch for its reliability. Please note that this notice is intended solely to alert readers that the content of this article is unreliable. We have not investigated whether the authors were aware of or involved in the systematic manipulation of the publication process.

Wiley and Hindawi regrets that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our own Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

References

[1] D. S. Vijayan, A. Mohan, C. Nivetha et al., "Treatment of Pharma Effluent using Anaerobic Packed Bed Reactor," *Journal of Environmental and Public Health*, vol. 2022, Article ID 4657628, 6 pages, 2022.

Hindawi
Journal of Environmental and Public Health
Volume 2022, Article ID 4657628, 6 pages
https://doi.org/10.1155/2022/4657628

Research Article

Treatment of Pharma Effluent using Anaerobic Packed Bed Reactor

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Received 19 February 2022; Accepted 19 April 2022; Published 17 May 2022

Academic Editor: Sivakumar Pandian

The treatment of pharmaceutical effluent using an appropriate technology has become so important. Anaerobic packed bed reactor is an efficient method for pharmaceutical effluent treatment because of the high organic content present in it. In this study, a heavy-polluted pharma effluent is treated using an anaerobic packed bed reactor. The performance of the anaerobic reactor was identified with respect to chemical oxygen demand (COD) removal, methane yield, and gas production. The results showed that COD was reduced from 73% to 60% for an organic loading rate (OLR) of 0.6036–1.7487 kg COD $m^{-3}{\cdot}d^{-1}$. As the OLR increases, the removal efficiency of COD decreases gradually to around 52% for an OLR of 2.34 kg COD $m^{-3}{\cdot}d^{-1}$.

1. Introduction

Pharmaceutical industries reach the most critical worldwide needs, through providing active pharmaceutical ingredients. This industry deals with environmental pollution issues during the manufacture of drugs or active pharmaceutical ingredients. The effluents which come out of such industries are highly hazardous and toxic. Pharmaceutical effluents have a greater impact on human health and environmental exposure due to their acute toxicity, genotoxicity, and mutagenic effects [1]. It is challenging to treat pharmaceutical wastewater to meet with the effluent standards because of the different types of drug production in the pharmaceutical industry [2]. The disposal of such effluent without proper treatment will cause harmful effects to the human as well as the environment [3]. A common treatment method cannot be employed to treat all pharmaceutical effluent because of its different composition [4]. An objective of this project is to find out whether an upflow anaerobic packed bed filtration method is capable of improving pretreatment of pharmaceutical wastewater which is collected from a pharma plant in Pandithamedu, Chennai, for drug residual concentrations with a combination of feed stream and hydraulic retention time (HRT). The pharmaceutical industry is a potential industry which is responsible for a large scale of pollution. It is one of the major consumers of water and about 60% of the used water is discharged as a waste. Pharmaceutical wastewater contains various pollutants which when discharged into various recipients causes a potential adverse impact on the environment. Various treatment methods for the waste produced by the pharmaceutical industries have been employed, but the challenge remains unresolved in many developing countries and pollutants are still chronically treated. So, the treatment of this effluent has been a serious problem engaging attention of all concerned including industries.

1.1. Anaerobic Digestion. Anaerobic digestion is the process by which microorganisms gain energy and grow by

assimilating organic matter without oxygen. It results in methane production [5]. It requires low energy and less space requirements [6]. The high-rate anaerobic treatment systems involve retention of biomass whereas the low-rate systems do not involve biomass retention [7]. High-rate systems have less HRT and more sludge retention time, and it can be used to treat different wastewaters. Low rate systems are used to digest slurries and have a high HRT [8].

Anaerobic decomposition is mostly carried out in anaerobic digesters by a group of bacteria known as methanogens and acetogens, which do not use oxygen as an electron donor and instead absorb electrons from acetate and methane for energy production [9]. The "three-phase separation" of water, gas, and sludge and the rate of distribution of effluent in the reactor are the most important factors influencing the treatment efficiency of the reactor [10]. Anaerobic digesters are classified as continuous or batch digesters. In a continuous digester, the substrate is continuously added. The process's waste, methane, is continuously removed. This maintains the reactor's composition. They are a fast digester. Methanogens are mesophilic and thrive in temperatures between 30 and 38 degrees Celsius. This is the mesophilic temperature. In a continuous digester, the substrate is continuously added. The process's waste, methane, is continuously removed. This maintains the reactor's composition. They are a fast digester. Methanogens are mesophilic and thrive in temperatures between 30 and 38 degrees Celsius. This is the mesophilic temperature. It is essential that the generated gas be collected before the filtered water exits the reactor but not required that the sludge remain in the reactor.

Numerous modern anaerobic technologies, including the upflow anaerobic sludge blanket (UASB), anaerobic membrane bioreactor (AnMBR), the anaerobic sequencing batch reactor (AnSBR), the moving bed biofilm reactor (MBBR), and other hybrid technologies, have demonstrated their efficacies in the efficient treatment of pharmaceutical wastewater. The upflow anaerobic sludge blanket (UASB) is the most widely used high-rate anaerobic device for home and industrial wastewater treatment. Ince et al. [11], at 65% COD elimination, found that an upflow anaerobic filter (UAF) had poor performance on a chemical synthesis-dependent pharmaceutical wastewater with a low methane yield [12]. In a study conducted by Ji et al. [13], acute toxicities were measured using a median 15-minute inhibitory concentration (IC_{50}) at pH 7.00 ± 0.05 to test the effect on anaerobic digestion of anaerobic intermediates and antibiotics. Results indicated that the presence of IC_{50}which having the compounds such as ethanol, acetate, propionate and butyrate and their values are identified after the removal of toxicity as 19.40 g·L^{-1}, 20.71 g·L^{-1}, 10.47 g·L^{-1} and 12.17 g·L^{-1}, respectively.

In any treatment, the higher concentration of dissolved oxygen (DO) and high chemical oxygen (HCD) was introducted in a upflow anaerobic sludge blanket (UASB) with an organic loading rate of 8.11 g COD/L/d has been added in the anaerobic digester with 41.2% COD removal efficiency and with slime loading rate of 2 days was need to maintained in the digestor. Salinity over a concentration of TDS 14.92 g/L was shown to have a harmful effect during the anaerobic treatment. A sequence batch reactor (SBR) was completed to increase the effluent of microbial biomass. The UASB + SBR performed strongly in organic matter and eliminated 94.7% and 91.8% of COD. Overall, the UASB + MBR method displayed enhanced removal and nitrification performance [14]. Ejhed et al. [14] have shown sludge processes to extract hormones more effectively than trickling filtration. As a result, the elimination of pharmaceuticals, hormones, turbidity, and total nitrogen all improved as well. It was suggested that, during final stage of treatement the Reduction of estrone, ibupremoride, estradiol, and naproxen, has provide positive outlet which linked to the fludrate free sludge and sludge-like materials. Thus, technological methods may be adjusted to increase the OWTF's performance by increasing retention time [13].

Svojitka et al. [15] conducted a study in order to determine the effectiveness of long-term treatments and to find out whether there were any initial resistance causes. Addition of methanol (COD removal ≥97%) to the influent yields the fastest COD removal. In an anaerobic bioreactor, generally a lower COD removal efficiency (78%) was observed (gathered from incoming pharmaceutical wastewater) after the treatment. Waste organic solvents (more than 2.5 g/L of dissolved organic carbon) added to the influent triggered anaerobic digestion [16]. Wang et al. [17] showed that a biological approach was critical to the overall removal of COD (chemical oxygen demand). Activated carbon sorbent was used as a follow-up procedure to further extract the nondesorbable elements. Results found that the COD reduction and biodegradability were approximately 66.9% and 98.9%, respectively, during the pretreatment, as the percentage of original COD was shown forbefore treatment were 0.16 to 0.41% and increased from 0.02 to 0.17% to 0.2% to 0 in the post treatment of effluent. The total rate was approximately 96% for COD, and the total effluent COD exceeded the tertiary standard (GB 89.5 1996).

When it comes to constructing the wastewater treatment process, the organic input rate is quite important. The type of organic substrates to be added and the type of wastewater to be treated determine the best range of organic loading rates. The addition of large amounts of external organic component is required to successfully treat wastewater with a low COD, such as mining and metal processing effluent. Oktem et al. [12] conducted a laboratory-based analysis in a pharmaceutical wastewater-based chemical synthesis on the efficiency of a lab-based hybrid upflow anaerobic sludge blanket (UASB) reactor. The COD reduction of 72% in the reactor system was achieved at an OLR of 8 kg COD m^{-3}·d^{-1} [18]. An 85–90 per cent of COD and more than 90 per cent of sulphate removal were obtained at an OLR of 1.5 kg COD m^{-3}·d^{-1} and HRT of 8.3 days, containing 3200 mg·L^{-1} of sulphate. However, when COD removal fell to 70 percent when the charge rate was increased to 2.09 kg COD·m^{-3}·d^{-1} by reducing the HRT by seven days, the reactor output was affected. The experiment on the handling of pharmaceutical wastewater in large mass-drug manufacturing units was carried out by Venkata Mohan et al. [18] with the anaerobic suspended film contact reactor (ASFCR). Organic charging rates rose between 60 and 80 percent and methane was about 60–70 percent, with COD m^{-3}·d^{-1} reduced from 0.25 to 2.5 kg [19].

In the intial stage of treatment, the alum has been used to extract the values of turbidity as 69.2%, TSS as 79.6% and part of BOD as 34.8% and COD as 48.6%, in the chemical coagulant [4]. In the Sand filtration method, the chemical are used after the processing which resulted in high deletions of TSS values such as 97.7%, 95.7%, COD as 93.9% and 76.9% of turbidities. The final phase of the recovery programme was GAC. The influential phenol concentration in GAC adsorption was less than 0.002 $mg{\cdot}l^{-1}$ at 73 mg/l. Akbarpour Toloti and Mehrdadi [20] have demonstrated the operation on the ground and predicted that the UASB reactor could be used as a successful pretreatment alternative for treating drug wastewater because of its composition, and lightweight nutrients, such as a sugar solution, should be added to it, and alkalinity reduction could result in lower reactor efficiency [17].

The reactor transforms methane to heavier hydrocarbons without producing carbon dioxide (CO_2). A scaled-up version of the method may contribute to the reduction of methane venting and flaring at remote oil locations. Oktem et al. [12] clarified the efficiency of an upflow anaerobic filter (UAF). It showed 65% removal of COD with low yield value of methane compounds such as 0.20 m^3 volume of CH3 and CH4 with minimum kg of COD−1 dependent on the chemical synthesis pharmaceutical wastes (bacampicillin and sultamicillin tosylate) [20]. Of the 6 antibiotics, such as tylosine, tetracycline, lyncomycin, penicillin, sulphamethazine, and carbadox, the impact from antibiotics on a pseudoanaerobic digestion of pork slurry (SBR) was predicted to be applied to the pig diet by Masse et al., (2000). It was determined that the methane activity was affected only by penicillin and tetracycline [21].

2. Materials and Methods

The methodology of the study includes fabrication of the reactor and its applicability for the anaerobic digestion of pharmaceutical wastewater and evaluation of the packed bed reactor.

2.1. Experimental Set Up. Figure 1 shows the experimental set up for the present study. Components present in the reactor set up are as follows:

(1) Feed tank/influent tank (overhead tank)
(2) Collection tank
(3) Packed bed reactor
(4) Methane gas collector

2.1.1. Feed Tank. The influent wastewater is allowed to flow upward through the packed bed reactor using an overhead tank with a valve to control the influent flow. The inlet of the reactor is placed at the bottom, and the outlet is placed at the top of the reactor, thus bringing it in contact with the sludge blanket in the reactor. Also, to prevent the unwanted sludge discharge, deflectors are installed, forcing the sludge to sink back into the bed [22].

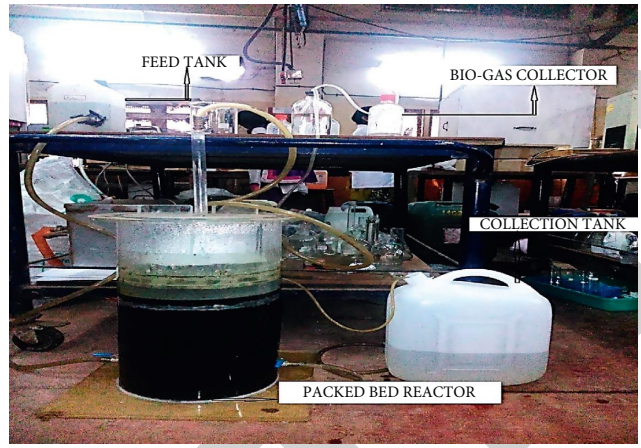

Figure 1: Experimental set up.

2.1.2. Collection Tank. The water in the packed bed of the packed reactor was boiled, and the vapour was accumulated in the tank.

2.1.3. Packed Bed Reactor. It is a cylindrical structure made up of acrylic material with a holding capacity of 24.5 L, where the operating volume hold 12.3 L with 25 cm length polypropylene pall rings used as a media packing.

2.1.4. Methane Gas Collector. Degradation of the wastewater by the microbes, results in the methane gas production as a by-product [23, 24]. Thus, the gas produced is to be collected with the help of methane gas collector. Biogas production for the assessment of methanogenic activity during the working of the reactor has been observed. The biogas measurement was carried out by using the water displacement method.

3. Result and Discussion

Pharmaceutical wastewater is tested using normal methods for the physical and chemical properties such as pH, BOD, COD, and the settleability of the sludge. Chemical characteristics are mentioned in Table 1.

3.1. Effect of Temperature. The optimum of anaerobic degradation process is achieved at a temperature between 25 to 35°C. The digestion rate decreases by 11% for every degree C below 25°C temperature [25]. To control acidification of the process and to maintain a stable microbial degradation, it is necessary to maintain a water temperature of minimum 15°C [18].

3.2. Effect of Retention Time. The hydraulic retention time (HRT) for which the wastewater is in the reactor. The reactor volume ratio and wastewater flow rate are calculated. HRT has a great influence over the reduction of COD and is important to achieve the desired degradation rate [26]. From the various hydraulic retention time operation, 2 days is kept constant. The various influent and effluent characteristics of wastewater are shown in Tables 2 and 3.

Table 1: Characteristics of pharmaceutical wastewater and treated sludge.

Parameters	Pharmaceutical wastewater, mg/l	Treated sludge, mg/l
pH	6.81	7.1
BOD	2480	5274
COD	6400	9730
TDS	1084	—
TSS	157	—
Volatile solids	—	8480
Suspended solids	—	18470

Table 2: Characteristics of influent and effluent water in the proportion 1 : 3 at various HRTs.

Sl. no.	Parameter	Influent concentration, mg/l	Effluent concentration, mg/l at 1 day HRT	Effluent concentration, mg/l at 2 days. HRT	Effluent concentration, mg/l at 3 days. HRT
1	pH	6.51	6.1	6.7	7
2	BOD	630	189	165	160
3	COD	1650	495	446	429
4	TDS	265	80	53	53
5	TSS	43	33	30	28

Table 3: Characteristics of influent and effluent water in the proportion 1 : 2.

Sl. no.	Parameters	Influent concentration, mg/l	Effluent concentration, mg/l at 48 hrs
1	pH	6.57	6.63
2	BOD	1235	410
3	COD	3335	1200
4	TDS	538	103
5	TSS	79	49

Table 4: Characteristics of influent and effluent water in the proportion 3 : 1.

Sl. no.	Parameters	Influent concentration, mg/l	Effluent concentration, mg/l at 48 Hrs
1	pH	6.73	6.7
2	BOD	1850	685
3	COD	4780	1865
4	TDS	813	244
5	TSS	115	63

Table 5: Characteristics of influent and effluent water at 48 hrs.

Sl. no.	Parameters	Influent concentration, mg/l	Effluent concentration, mg/l
1	pH	6.81	6.8
2	BOD	2480	1265
3	COD	6400	3072
4	TDS	1084	336
5	TSS	157	85

The effluent concentration of the pharmaceutical wastewater in the proportion of 1 : 3 at 1-day interval for the organic loading rate 0.6036 kg COD/m^3 day has an COD removal of 70%.

The effluent concentration of the pharmaceutical wastewater in the proportion of 3 : 1 as shown in Table 4 at 2 days' interval for the organic loading rate of 1.7487 kg COD/m^3 day has an COD removal percentage of 61%.

The effluent concentration of the pharmaceutical wastewater at 2 days' interval as shown in Table 5 for the organic loading rate 2.3414 kg COD/m^3 day has a COD removal of 52%.

3.3. Effect of COD Removal. The average COD decline was about 70% in the OLR of 0.6036 kg COD $m^{-3}{\cdot}d^{-1}$. However, the efficiency of removal of COD as shown in Figure 2, decreased slowly until 60%–65% of COD removal was found, when the OLR was increased to 1.2201 kg COD $m^{-3}{\cdot}d^{-1}$. Furthermore, the further increase of the COD

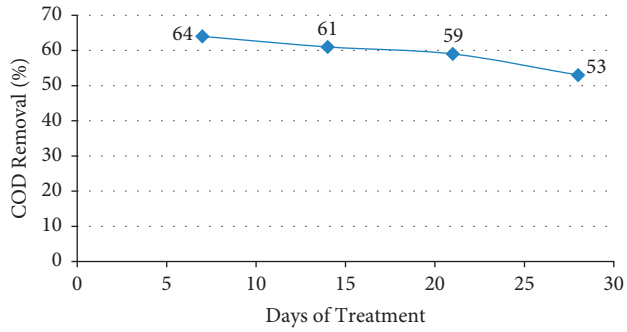

Figure 2: COD removal percentage.

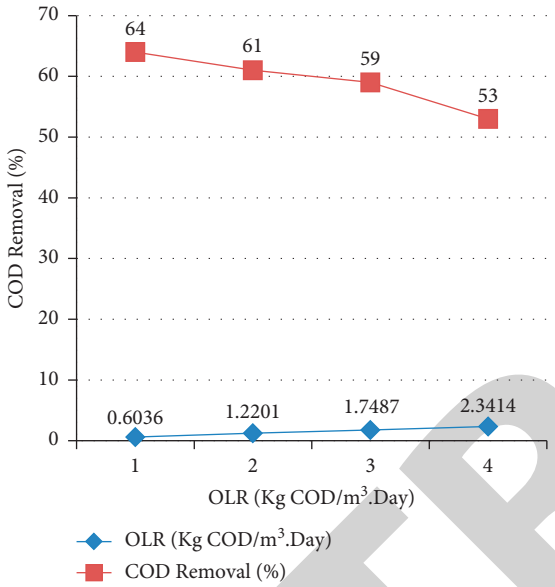

Figure 3: COD removal percentage at various OLRs.

Table 6: Biogas production at different OLRs.

Sl. no.	COD, mg/l (influent)	COD, mg/l (effluent)	Water displaced, ml/d
1	1650 at 24 hrs	495	21
2	1650 at 48 hrs	446	19
3	1650 at 72 hrs	429	18
4	3335	1200	15
5	4780	1865	12
6	6400	3072	10

$m^{-3}{\cdot}d^{-1}$ OLR by 2.3414 kg resulted in a removal of just around 52% COD, which is shown in Figure 3.

COD removal percentage gets reduced when the rate of organic loading increased. Thus, the COD removal percentage is efficient in the lower organic loading rate. Therefore, the COD removal percentage is greater at a low organic loading rate and greater hydraulic retention time.

3.4. Biogas Composition. Methane gas output was observed for methanogenic activity investigation in the reactor during its functioning as shown in Table 6. When the OLR is poor (0.6036–2.3414 kg COD $m^{-3}{\cdot}d^{-1}$), the reactor was comparatively higher in methane output by approx. 60–70%.

4. Conclusion

It could be concluded that the pharmaceutical effluent treatment using anaerobic packed bed reactor is effective. The treatment is conducted using an acclimated biomass, resulting in high COD degradation. The variation in HRT has an impact over the reactor operation; it increases the acid genic activity and reduces the methanogenic activity. The rate of degradation depends on the wastewater composition and the organic loading rate (OLR). The observed status in the reactor is:

(i) It is identified that the pharmaceutical wastewater has a greater amount of COD value; thus, it is necessary to reduce the COD range.

(ii) Microbes present in the reactor used for the degradation of pharmaceutical wastewater have relatively high efficiency concerning COD reduction.

(iii) The reactor has a greater removal efficiency when there is an increase in hydraulic retention time.

(iv) It is observed that the pH value between 6.6 and 7.6 is optimum for the microbial growth.

(v) For the microorganism growth, the pH can be maintained stable using the buffer solution sodium hydroxide.

(vi) Therefore, there is a decrease in the efficiency of the removal of COD when the organic loading rate is increased.

Data Availability

The authors declare that the data supporting the findings of this study are available in the form of figures and tables within the article.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

References

[1] S. Chelliapan, A. Yuzir, M. F. M. Din, and P. J. Sallis, "Anaerobic pre-treatment of pharmaceutical wastewater using packed bed reactor," *International Journal of Chemical Engineering and Applications*, vol. 2, 2011.

[2] C. Y. Chang, J. S. Chang, V. Saravanamuthu, and J. Kandasamy, "Pharmaceutical wastewater treatment by membrane bioreactor process—a case study in southern Taiwan," *Desalination*, vol. 234, 2008.

[3] D. Dolar, K. Kosutic, T. Ignjatic Zokic, L. Sipos, and M. Zupan, "Combined methods of highly polluted pharmaceutical wastewater treatment—a case study of high recovery," *Polish Journal of Environmental Studies*, vol. 22, 2012.

[4] M. Saleem, "Pharmaceutical wastewater treatment: a physiochemical study," *Journal of Research (science)*, vol. 18, pp. 125–134, 2007.

Hindawi
Journal of Environmental and Public Health
Volume 2023, Article ID 9786069, 1 page
https://doi.org/10.1155/2023/9786069

Retraction

Retracted: Research on Teaching Design of Geochemistry and Biology under the Background of Ecological Environment and Information Technology

Journal of Environmental and Public Health

Received 26 September 2023; Accepted 26 September 2023; Published 27 September 2023

This article has been retracted by Hindawi following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of one or more of the following indicators of systematic manipulation of the publication process:

(1) Discrepancies in scope

(2) Discrepancies in the description of the research reported

(3) Discrepancies between the availability of data and the research described

(4) Inappropriate citations

(5) Incoherent, meaningless and/or irrelevant content included in the article

(6) Peer-review manipulation

The presence of these indicators undermines our confidence in the integrity of the article's content and we cannot, therefore, vouch for its reliability. Please note that this notice is intended solely to alert readers that the content of this article is unreliable. We have not investigated whether authors were aware of or involved in the systematic manipulation of the publication process.

Wiley and Hindawi regrets that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our own Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

References

[1] L. Jiang and N. Yu, "Research on Teaching Design of Geochemistry and Biology under the Background of Ecological Environment and Information Technology," *Journal of Environmental and Public Health*, vol. 2022, Article ID 3785862, 8 pages, 2022.

Hindawi
Journal of Environmental and Public Health
Volume 2022, Article ID 3785862, 8 pages
https://doi.org/10.1155/2022/3785862

Research Article

Research on Teaching Design of Geochemistry and Biology under the Background of Ecological Environment and Information Technology

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Received 16 March 2022; Revised 29 March 2022; Accepted 4 April 2022; Published 21 April 2022

Academic Editor: Sivakumar Pandian

The current social situation is that the rapid development of science and technology has brought about rapid economic growth, but the wanton development of ecological environmental resources, resulted in environmental deterioration, so that human survival faces major challenges. This is not only the current state of life but also an urgent problem that people will work together to solve. Therefore, in order to cultivate environmental awareness, make students intuitively and clearly understand the benign operation of ecological environment and the close relationship between people and the environment, this paper designs and studies the existing information technology to design biology teaching on the basis of the sustainable development of ecological environment and encourages students to strengthen the protection of the environment. This paper studied and designed the practical inquiry, analysis, and questionnaire survey. The experimental results show that the students in information technology teaching perform better than the traditional students, which can stimulate students' enthusiasm, arouse their interest in learning, and deepen students' understanding. The number of outstanding students increased by 5, and the number of failed students decreased by 8. The research significance of this paper is to provide new teaching design ideas for the existing biology teaching mode so that the development of information technology can benefit biology teaching.

1. Introduction

Ecological environment is the basis of human survival and life. Only when the ecological environment is well developed, can human beings be safe and guaranteed. However, the current ecological environment is not optimistic. Due to people's unreasonable development and utilization of nature, the balance of the ecosystem is destroyed, the ecological crisis is deepening, and the bad weather occurs frequently. In order to enable students to better understand the operation of nature and ecosystems, teaching biology with modern information technology is a good teaching method.

Currently, there are many studies on teaching design in the context of information technology. For example, Qianqian and Yao said that in the face of the current curriculum reform, information technology has been widely used in junior middle school teaching, and the combination of information technology and biology teaching has become the main trend in the development of biology teaching [1]. Yan Jiasheng said in relevant research that although high school biology accounts for only a small part of the college entrance examination results, it is also a very important high school course and plays a very important role in students' comprehensive scores [2]. Gao said that the deepening of the new technological revolution has promoted the application of information technology in the field of education, profoundly affected the process of classroom teaching reform in different disciplines, injected infinite vitality into the classroom, and promoted the overall improvement of classroom teaching quality [3]. Ye said that the development of modern information technology has gradually become an important auxiliary to the current teaching work. Using information technology to carry out teaching work can bring a new style to biology teaching and realize efficient

classroom construction [4]. Therefore, the teaching design of biology under information technology is a research direction worth trying.

This paper begins with a simple understanding of the concept of ecological sustainable development and then studies the relevant knowledge and materials of information technology. Then, it explores and designs the network teaching platform, designs the teaching process, and studies the microcourse teaching and inquiry teaching methods under information technology. Finally, the conclusions were drawn by comparing the experiments and the questionnaires.

Interest is an important driving force to acquire knowledge, and the use of information technology to strengthen the intuition in the teaching process can not only attract students but also stimulate students' thirst for knowledge. Multimedia is used to show the microworld, macroscale the microcontent in biology, improve the teaching efficiency, and promote the effectiveness of teaching.

2. Biology Teaching Design Based on the Sustainable Development of Ecological Environment and Information Technology

2.1. Ecological Sustainable Development

2.1.1. Development Evaluation. An ecosystem is mainly composed of several elements, such as nature, economy, and social life. The ecological quality evaluation indicators mainly involve resources, environment, and population, that is, the degree of resource surplus, environmental quality, and the living conditions of the population [5]. The selection of eco-environmental indicators is affected by topography and has diversity. For example, it can be evaluated from the aspects of biological abundance, vegetation coverage, water network density, social economy, environmental factors, ecosystem, road traffic, urban expansion, and ecological landscape pattern. In 2021, the Ministry of Ecology and Environment will incorporate the biodiversity index into the comprehensive evaluation index system of ecological quality.

2.1.2. Ecological Environment Characteristics

Global: environmental problems are widespread around the world, with some environmental problems such as greenhouse effects, ozone layer depletion, and acid rain. It has the most diverse influences and harms for the whole world and all mankind.

Sociality: from the perspective of social life, ecological issues have covered all aspects of society [6].

Political: the social nature of ecological problems will inevitably lead to political problems.

Integrity: integrity means that the various components and elements of the ecological environment form a system [7, 8].

Uncertainty: the so-called uncertainty refers to the inability to accurately predict the impact of current ecological problems on the future. The main reason for uncertainty lies in the limited knowledge and practical characteristics.

Irreversibility: ecoenvironmental problems have irreversible characteristics, mainly manifested in the disappearance of resources and populations.

2.1.3. Ecological and Environmental Issues

(1) Ozone layer destruction: it is widely used in industrial, agricultural, and household sprays (chlorofluorocarbons for deodorants) and high-altitude aircraft, which are the killers of the ozone layer.

(2) Acid rain: industrial production and the development of thermal power have greatly increased the emissions of air pollutants.

(3) Land resources: soil depletion, soil degradation, soil erosion, and land salinization have become serious problems all over the world.

(4) Natural resources: due to excessive deforestation, overgrazing of grasslands, and destruction of mountain tree planting, the desertified areas are expanding day by day.

(5) Water resources: improper treatment of industrial and urban sewage pollutes rivers, lakes, and groundwater and further aggravates the severity of the freshwater resource shortage.

(6) Mineral resources: the development and utilization of mineral resources caused serious damage and waste.

(7) Air pollution: air pollution is mainly concentrated in cities, and coal and automobile exhaust are the main sources of pollution.

(8) Waste pollution: the disposal volume of industrial solid waste and municipal waste is increasing.

(9) Biodiversity is reduced: due to environmental degradation, the rate of biodiversity reduction is accelerating [9].

2.2. Information Technology

2.2.1. The Status Quo of the Application of Information Technology in the Inquiry-Based Teaching of High-School Biology. At present, there are many research studies on the integration of information technology and courses, but relatively few research studies are related to biology. The content mainly involves the research of information technology in promoting the transformation of learning methods in biology teaching. The application of resources ignores the subject characteristics and operability [10].

2.2.2. The Theoretical Basis of Information Technology and Curriculum Integration. The integration of information technology and curriculum serves teaching and learning, so it is inseparable from the theoretical basis of teaching and learning.

2.2.3. The Significance of Information Technology and Curriculum Integration. The integration of information technology and curriculum is mainly designed to select the appropriate tools in the subject teaching. It can effectively organize and integrate the teaching content and promote the implementation of collaborative teaching strategies. In a computer-based interactive multimedia learning environment, students can choose the learning content suitable for their own level. At the same time, students can use multimedia to watch, listen, and operate manually. Students' independent learning cultivates students' ability to obtain information and grasp information and improves their interest in learning. At the same time, the information technology collaboration teaching strategy can give multiple learners the opportunity to observe, compare, analyze, and synthesize the same problems from different perspectives, in order to reflect [11, 12].

2.2.4. Advantages

(1) Teaching information is more abundant: information technology can be used to create a certain teaching situation with rich material resources, provide students with more various forms of materials and information, and help students understand the teaching content.

(2) Independent study and independent development: students can use the communication methods provided by the online courseware to conduct independent exploration and research.

(3) Convenient and economical: once the online course system has been constructed, in the subsequent use process, various inputs such as manpower and funds are relatively small.

2.3. Network Teaching Platform. Based on the demand results analyzed from the perspective of information ecology, the entire online education platform is designed with the information ecological balance as the entry point for the development of the online education platform. To build an online education platform, based on realistic teaching, to achieve resource sharing, it is necessary to focus on the internal architectural design of the online education platform.

The system design based on the evolution of the information ecology is mainly the opening of the system source code and the interfaceization of the production of online courses. The design idea of the entire platform is led by the "information man," centered on the distribution and accumulation of information resources, using superior hardware facilities, and citing the internal framework of the concept of information ecology to build an information cycle system [13], as shown in Figure 1.

As a software project of an online education platform, its purpose is to achieve a more reasonable internal structure of the online education platform, more efficient use of resources, and closer communication and connection of information people. Therefore, in the whole system design process, we pay more attention to the design of logical flow. The logical structure is mainly divided into three major parts, namely the back-end management layer, the front-end display layer, and the database storage [14].

With the rise of the Internet, WEB technology has become more and more mature, and the B/S structure has emerged at the right time. Its basic working mode is that users access and share all information in server-side database storage with the client's browser. Its architecture mainly includes three major sections in Figure 2.

(1) Configuration environment for system operation:
Server-side configuration environment requirements:
Operating system: WinXP/win2013 server
Database management system: SQL Server Web
Server: Microsoft IIS 6.0 and above
Hardware requirements: Intel (R) Celeron (R) 540 and above

(2) Client configuration environment requirements:
Operating system: WinXP/win2003 server/Win7/Win8
Browser: Microsoft Internet Explorer 5.0 and above
Hardware requirements: Intel® Celeron® 430 and above

2.4. Teaching Design

2.4.1. Meaning. Teaching design can arrange all kinds of teaching resources reasonably and effectively so that it can maximize the scientific, serialized, behavioral, artistic, and other effects. First, the instructional design highlights the subjective status of the students. Secondly, the teaching design can effectively control the teaching process. Third, teaching design can standardize teaching activities. Finally, teaching design can effectively improve teaching efficiency and teaching effect [15, 16].

2.4.2. General Process

(1) Learning demand analysis is the analysis of the gap between learners' knowledge, skills, emotional attitude, and current values and the educational goals set in the expectation. Learning content actually refers to the "recent development area," that is, the part that shortens the gap between reality and expectations [17, 18].

(2) The learning objectives involve the expected changes in knowledge, skills, emotional attitudes, and values brought by the learners through the content of the course.

(3) The design of the teaching process is the "climax" of each link of the teaching design. After completing the positive analysis, the starting point, end point, and teaching strategy of teaching are determined, and in the process of teaching design, these various

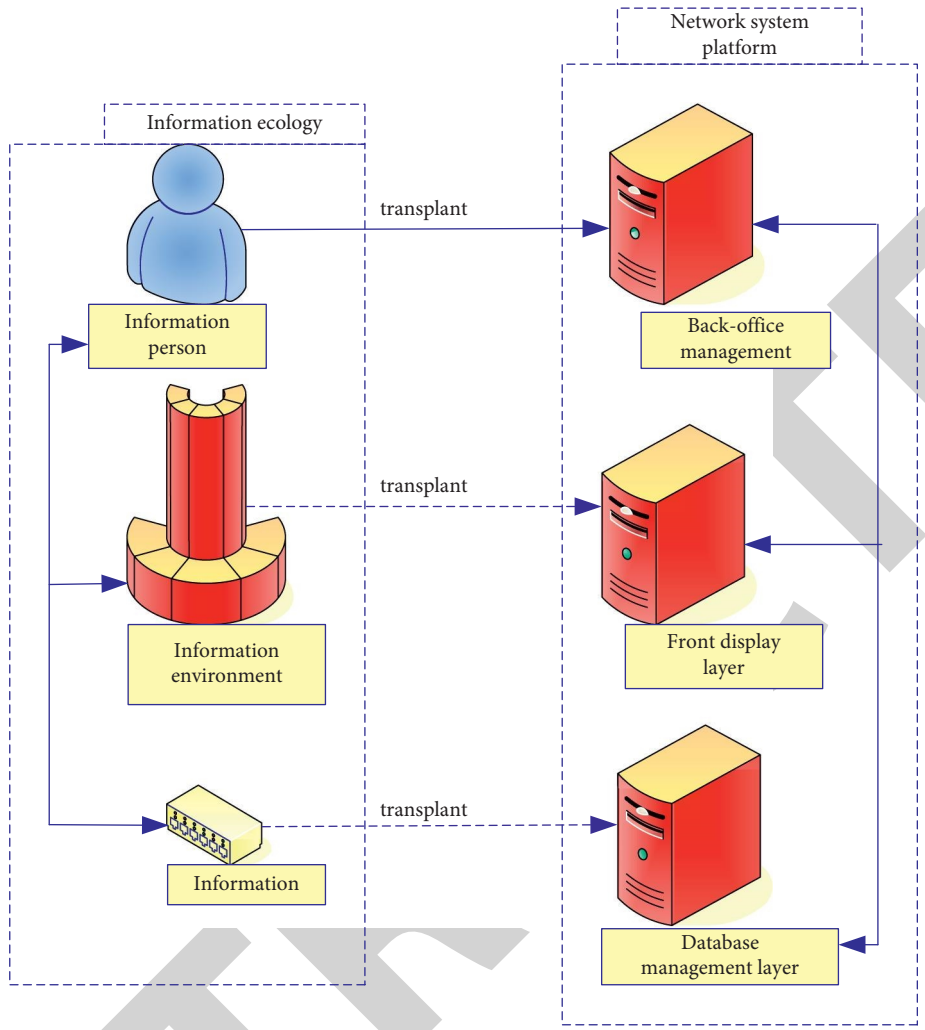

Figure 1: Information circulation system.

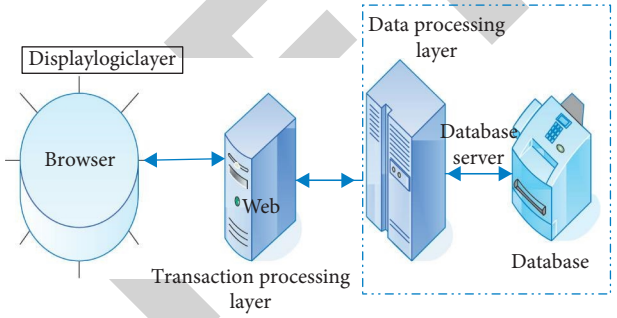

Figure 2: B/S architecture.

resources are made reasonable, orderly, and scientific, and services are provided for learners.

(4) Teaching evaluation is to verify whether the teaching has reached the prescribed teaching goals. This paper evaluates the effect of biological teaching design based on information technology through the association rule algorithm.

People often express association rules in a common form $M \Rightarrow N$ and measure the strength of association between M and N in association rules. Two indicators, support and confidence, need to be used.

Support $(M \Rightarrow N)$ represents a subset of both M and N in the database. The formula can be expressed as follows:

$$\text{Support}(M \Rightarrow N) = \text{Support}(M \cup N) = Q(M \cup N). \quad (1)$$

Confidence $(M \Rightarrow N)$ is the proportion of transactions that contain both M and N to the transactions that contain M, expressed as follows:

$$\text{Confidence}(M \Rightarrow N) = \frac{\text{Support}(M \cup N)}{\text{Support}(M \cup N)} = Q(N|M). \quad (2)$$

2.5. Problem-Oriented Teaching Design Supported by Information Technology. The problem design of problem-oriented teaching should follow the principle of "Trinity." First, the teaching knowledge points in the teaching are to be reviewed and summarized, students should be allowed to edit and organize them through the screen, present them in the form of mind maps, and finally express their opinions.

In today's classroom teaching, PPT courseware has almost become one of the teaching aids that every teacher

must use. Knowledge visualization is the application of visual representation of the creation and transmission of complex information between two or more people. The visual design principles of PPT courseware are as follows:

(1) The characters are large and few. Facts show that students do not like to see slides with large sections of text, which prevents students from seeing the subject at a glance.

(2) The format of this table is different from the picture, and the table is not as good as the picture. If you can use pictures to express information, try not to use tables. Using animation and video to convey information is better than using images.

(3) Xuetong is not only suitable for online learning but also for offline classroom learning and training. It can organize and carry out various classroom activities. It can also learn, collect, count, and manage feedback and homework from students in each class.

2.6. Feasibility Analysis of the Application of Microclasses in Biology Teaching

(1) Effectively improve the ability of students to learn independently: normally, if conditions permit, the school can allow students to use their mobile phones; then, teachers can set up a QQ group or Baidu network disk, make the knowledge points in the textbook into microclasses, and then pass them to the group file. Students can choose to watch microclasses according to their own situation and targeted learning.

(2) Enriching classroom teaching methods: in biology classes, lectures, exercises, discussions, etc. are usually used. Of course, we will still use microclasses to teach. Microclasses mainly present teaching content in the form of video, with small limitations, strong practicability, and novel methods, which enrich the classroom teaching methods.

(3) Obtain student feedback information in time: microclasses have the characteristics of "short," "small," and "precise," and the teaching content is complete. At the same time, in terms of knowledge points that you do not understand, you can also focus on learning knowledge points you do not understand. You can solve problems by repeatedly watching microclasses or reading textbooks, and communicating with classmates and teachers.

(4) Help students break through the key or difficult points of teaching: for novice teachers, there is not much teaching experience, and there are often situations where it is too late to complete the teaching task. Microclasses are just a breakthrough. Teachers can use microclasses to try to break through the difficult points of teaching and complete teaching tasks.

The teaching design plan is shown in Figure 3.

2.7. Construction of Inquiry Teaching Mode

2.7.1. Selection and Characteristics of Biological Content. The selection of biological inquiry teaching content is divided into four categories: the first category is the basic concepts and rules that constitute the biological subject system; the second category is exploratory experiments; the third category is scientific issues in daily life that are closely related to the content of learning; the fourth category is scientific frontiers, social hotspot issues, and cross-disciplinary comprehensive issues.

2.7.2. Mode Structure. The biological inquiry teaching mode under the information technology environment mainly includes the following five elements.

(1) Combining the curriculum standards and actual teaching conditions appropriately determine the educational goals.

(2) Teachers use multimedia tools, online teaching aids, virtual experiences, and other methods to show students the basic materials needed to explore new knowledge, create problem scenarios, and ask questions.

(3) After guiding students into the situation, they should guide students to research and solve problems by themselves, encourage students to clarify their views through self-study and debate, actively feel in the process of meaning construction, and gain knowledge in the process of exploration.

(4) Students and groups analyze and discuss in different ways, exchange their research results, and express research results in different ways. Teachers use multiple methods to evaluate all research activities.

(5) After the teacher discovers the biological law through the exploration of a specific situation, he can extend it in a broad sense, guiding students to explore the biological law in a more general situation, thereby discovering the applicable conditions of the original law, and making the study more in-depth.

3. Questionnaire

3.1. The Purpose of the Experiment. Through experiments in biology classrooms, to understand what benefits the inquiry-based teaching model based on information technology will bring to students, the main purposes are as follows:

Whether it can improve students' interest in biology;

Whether it can improve students' ability to discover and solve problems;

Whether it can improve students' innovative ability;

Whether it can improve students' information literacy ability;

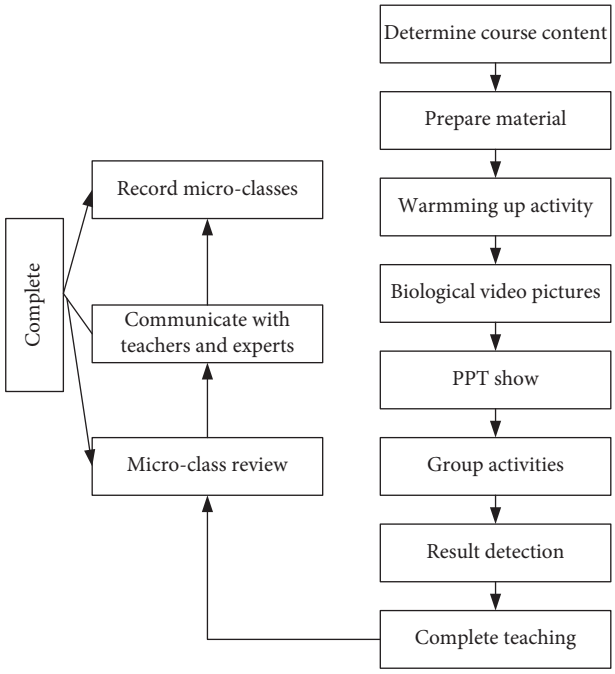

Figure 3: Biology instructional design process.

3.2. Scheme Design. This experiment is conducted using the controlled variable method. The experimental class is designed to compare with the control class. The experimental class uses information technology for biology teaching. The control class uses traditional teaching methods to learn. At the same time, it is necessary to maintain two classes of class hours, teaching content, and homework exercises. The content of the exam is the same.

3.3. Design of the Questionnaire. A questionnaire can have a more intuitive and clear understanding of the current situation, unify the different answers of questions for convenient analysis and comparison, and has a strong reference value. Therefore, this paper adopts the questionnaire method to investigate the learning effect of students after changing the teaching methods through information technology. The survey is designed in four aspects: whether students' learning attitude is improved; students' understanding of teaching content, and interest in biology courses are stimulated; and the impact of information technology on learning. These four aspects are used to understand the students' comprehensive learning situation.

3.4. Questionnaire Process. A total of 96 people were selected for this questionnaire, and they were divided into two groups. One group was a control group of 48 people who used traditional teaching methods to teach biology, and the other group was an experimental group of 48 people who used information technology to teach. A total of 100 questionnaires were issued, 96 of which have been filled out, and the effective response rate of the questionnaire was 96%. The questionnaire was followed up for one week.

Table 1: Biology teaching effect supported by information technology.

	Excellent	Good	Moderate	Poor
Learning attitude	23	12	6	7
Understanding of learning content	25	11	7	4
Interest	30	8	8	2
Impact	26	12	6	4

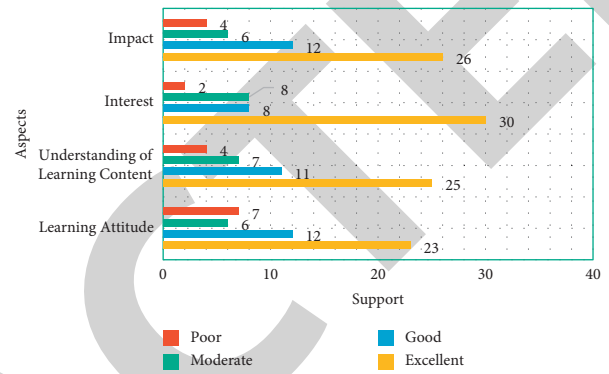

Figure 4: Biology teaching effect supported by information technology.

4. Analysis of the Results of Biological Teaching Design of Information Technology

4.1. Biology Teaching Effect Supported by Information Technology. Regarding students' attitudes and teaching effects of using information technology to learn biology, the specific conditions are shown in Table 1.

As shown in Figure 4, interest in biology is still the most important learning factor, and the recognition of the role of information technology in teaching is also relatively high. Regarding the teaching content, more than half of the students believe that information technology makes the teaching content easier to understand and master.

4.2. Analysis of the Learning Effect of the Experimental Class and the Control Class on Biology. After a period of teaching, the teaching effect of the control class and the experimental class is based on the student's performance. The results show that the control class has 12 outstanding students who study in the traditional teaching method, and 10 people fail to learn through information technology. Of the people, the biological scores have improved significantly, 17 of them are excellent, and only 2 of them fail. The specific situation is shown in Table 2.

4.3. Emotional Attitude Analysis of Control Class and Experimental Class. The emotional attitude of this survey includes interest, recognition of scientific rigor, active independent participation, and good teamwork. In the control class, most people are interested in biology courses, followed by recognition of scientific rigor, and more people

Table 2: Analysis of the learning effect of the experimental class and the control class on biology.

	Excellent	Good	Moderate	Poor
Control class	12	15	11	10
Experimental class	17	20	9	2

Table 3: Analysis of emotion and attitude of control class.

	Excellent	Good	Moderate	Poor
Interest	29	16	3	0
Scientific rigor	22	15	12	0
Autonomous participation	20	9	13	6
Like to cooperate	15	5	20	8

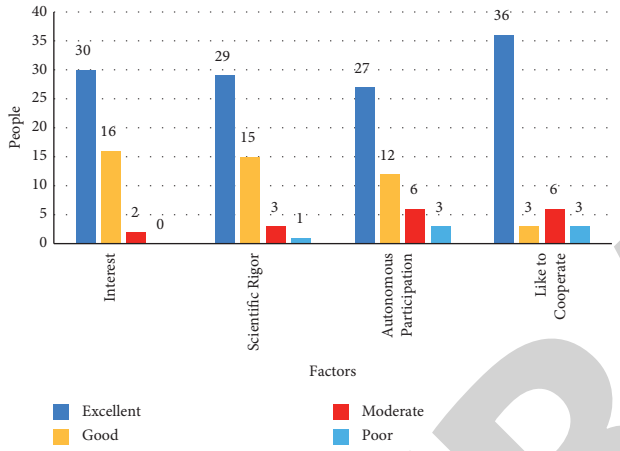

Figure 5: Emotional attitude analysis of experimental class.

have a neutral view of cooperation. The specific situation is shown in Table 3.

As shown in Figure 5, students in the experimental class are most supportive of teamwork in biology class, followed by interest in biology class. Of course, compared with the control class, the experimental class is generally better than the control class in the four aspects of the investigation. Therefore, the use of information technology for teaching can better cultivate students' interest and learning ability in class.

5. Conclusion

The ecological environment advantages of cities with superior resource endowment are easier to be transformed into economic advantages, and the ecological environment is the basis of the sustainable and stable development of the economy and society [19]. Today, the frequent occurrence of extreme weather around the world makes us clearly realize that human beings will bear the consequences of the deterioration of the ecological environment. In this information age, we can not only keep an eye on changes in the global ecological environment and understand the symbiotic relationship between human beings and the environment but also use information-based methods to guide teaching and intuitively understand biology. We can use video and virtual technology to understand the laws of nature, study in-depth the basic operation of the ecosystem, and deepen the study of biology so as to understand the importance of protecting organisms and protecting the environment. The integration of information technology into biology teaching can more effectively improve the existing biology classroom teaching mode and deepen the influence of biology, which is undoubtedly a good medicine for teaching reform [20]. Through experimental research and investigation, it can be seen that the use of information technology for instructional design and curriculum development is a more effective way for students to learn and master knowledge points. Information technology not only improves students' attention and interest in learning but also deepens students' understanding of knowledge. Therefore, the use of modern technology in biology teaching means teaching can achieve twice the result with half the effort. Of course, the role of information technology in the education of other disciplines also needs further research and exploration.

Data Availability

The data underlying the results presented in the study are available within the manuscript.

Disclosure

The authors confirm that the content of the manuscript has not been published or submitted for publication elsewhere.

Conflicts of Interest

The authors declare that there are no potential conflicts of interest.

Authors' Contributions

All authors have read and approved the manuscript for publication.

References

[1] W. Qianqian and X. Yao, "Research on the application of modern information technology in junior middle school biology teaching under the background of the new curriculum," *Tian Tian Ai Science (Teaching Research)*, vol. 124, no. 10, p. 12, 2019.

[2] J. Yan, "Research on the application of high school biology inquiry teaching mode under the information technology environment," *Education Information Forum*, vol. 57, no. 11, p. 172, 2019.

[3] M. Gao, "Talking about high school biology classroom teaching under the background of information technology," *Information Weekly*, vol. 21, no. 21, p. 1, 2019.

[4] Z. Ye, "Research on junior high school bio-efficient classrooms under the background of information technology," *Tomorrow*, vol. 8, p. 119, 2019.

[5] L. Liu, "On the application of information technology in high school biology teaching," *East, West, South and North: Education*, vol. 21, p. 84, 2019.

[6] M. Jiang, "Application of information technology in microbiology teaching under the background of "Internet+","