Hindawi
Wireless Communications and Mobile Computing
Volume 2023, Article ID 9871572, 1 page
https://doi.org/10.1155/2023/9871572

*Retraction*

# Retracted: Comprehensive Evaluation of Teaching Ability Based on Network Communication Environment

**Wireless Communications and Mobile Computing**

Received 1 August 2023; Accepted 1 August 2023; Published 2 August 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This article has been retracted by Hindawi following an investigation undertaken by the publisher [1].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. Su, G. Chen, and M. Li, "Comprehensive Evaluation of Teaching Ability Based on Network Communication Environment," *Wireless Communications and Mobile Computing*, vol. 2021, Article ID 5841822, 12 pages, 2021.

Hindawi
Wireless Communications and Mobile Computing
Volume 2021, Article ID 5841822, 12 pages
https://doi.org/10.1155/2021/5841822



*Research Article*

# Comprehensive Evaluation of Teaching Ability Based on Network Communication Environment

**Yawen Su,[1] Guofu Chen,[2] and Moyan Li[3]**

[1]*The Education University of Hong Kong, Hong Kong 999077, China*
[2]*School of Management, Xiamen University, Xiamen, 361005 Fujian, China*
[3]*School of Humanistic and Social Sciences, Shantou Polytechnic, Shantou, 515000 Guangdong, China*

Correspondence should be addressed to Moyan Li; myli@stpt.edu.cn

Received 30 June 2021; Revised 6 September 2021; Accepted 11 September 2021; Published 29 September 2021

Academic Editor: Zhihan Lv



With the continuous development of school teaching quality, the measurement of the current teaching ability level has become a concern of people. This research mainly discusses the comprehensive evaluation of the teaching ability level based on the network communication environment. This study uses fuzzy comprehensive evaluation method to comprehensively evaluate the system. First, obtain the representative evaluation standards of education informatization and a series of indicators related to informatization teaching at home and abroad; secondly, conduct a comprehensive analysis of the various evaluation standards and related indicators of informatization teaching that have been obtained; finally, the process in each indicator is discussed and revised by experts and relevant information technology teachers, and a number of schools are selected to conduct small-scale experimental evaluation experiments to form information-based teaching evaluation indicators. In this study, the proportion method is used to calculate the membership degree of each observation index based on the recovered data and establish the fuzzy relationship matrix of each evaluation factor. Paying attention to the level of index weights can guide the development direction of informatization teaching and promote the healthy development of informatization teaching. Therefore, this article uses the expert scoring method combined with the analytic hierarchy process to determine the weights in the evaluation index system. There is a significant difference between teachers in urban areas and teachers in rural areas ($p < 0.05$). The ratio of each grade of the teacher's informatization teaching ability comment collection is "bad 0.5%," "relatively poor 5.7%," "normal 35.3%," "good 53.1%," and "excellent 5.3%." This research will help promote the improvement of school teaching quality.



## 1. Introduction

The continuous increase in the number of high-level talents in schools and the continuous expansion of the scale of training in the future have enabled the rapid development of the number of high-level talents in our country and continue to meet the country's demand for high-level talents. For education disciplines, the purpose is not only to train students to master and use the multisubject cultural knowledge in the professional field, but also more importantly, the transformation and output of the absorbed knowledge is the cultivation of teaching ability, so that students can learn what they learn. Learners were externalized and assimilated through a certain way [1]. We respect the laws of education and the laws of students' physical and mental development, provide suitable education for each student, and promote each student's active and lively development. Nowadays, the highly developed informatization provides a favorable environment and conditions for the reform of basic education in our country. With the help of computer, multimedia, and network information technology, it has effectively promoted the modernization of education and promoted the gradual opening and popularization of education.

In the network communication environment, teachers should also master technical knowledge and skills such as computer operation, multimedia use, and the use of the Internet for information acquisition and search [2, 3]. According to the teaching needs, the understanding of technology, and the

characteristics of students, an informatization teaching design ability is based on the professional basis, the ability to design teaching and learning, that is, the ability of teachers to use teaching-related knowledge, skills, theories, and attitudes to design the process of teaching and learning.

The wireless body area network (WBAN) is expected to play an important role in the field of patient health monitoring in the near future and has received great attention from researchers in recent years [4]. Liu et al. believe that in LTE-A communication technology, device-to-device (D2D) communication is defined as the direct routing of data traffic between mobile user equipment (UE) that are close in space, which improves energy efficiency, throughput, latency, and performance. For spectral efficiency, in order to help researchers to systematically understand the emerging D2D communication, they are conducting a comprehensive investigation of the existing D2D-related research work, ranging from technical papers to experimental prototypes to standard activities, and outlines some open research issues that are worthy of further study. Although D2D communication enables researchers to integrate the previously disjoint ad hoc networks and the long-term development results of the centralized network field, their research is not innovative [5]. Tsiropoulou et al. believe that machine-to-machine- (M2M-) driven Internet of Things (IoT) is an emerging paradigm in which physical objects are not disconnected from the virtual world but aim to provide contextual services together, requiring enhanced and more energy-efficient resource management methods. Although the method they proposed enables the devices in the cluster to collect and store energy in a stable manner through the use of WPC paradigm radiofrequency (RF) signals with the support of the cluster head, it does not prove that the operation of the entire M2M network can be extended [6]. Hu et al. believe that one of the challenges is to establish a secure communication architecture between the sensor and the user, while solving the widespread security and privacy issues. They proposed a communication architecture for BAN. Although they also evaluated its performance in terms of energy consumption and communication/computing overhead, the research process still lacks data [7]. Xu et al. believe that millimeter wave communications are expected to provide an order of magnitude improvement in capacity. However, due to high path loss and congestion, achieving sufficient link margin is challenging. To solve this problem, they discussed the potential benefits of ultradensity in enhancing millimeter wave communications from a network-level perspective. By deploying millimeter-wave base stations (BS) in an extremely dense and amorphous manner, the access distance can be shortened and the selection of BSs can be enriched for each user, which has an intuitive effect on reducing propagation loss and congestion [8, 9]. Nevertheless, cochannel interference under this model will become a performance limiting factor. Although their research can guarantee the scalability of the proposed coordination framework, however, it is not reliable to use only large-scale interference link CSI [10].

This research mainly discusses the comprehensive evaluation of the teaching ability level based on the network communication environment. This study uses fuzzy comprehensive evaluation method to comprehensively evaluate the system. First, we obtain the representative evaluation standards of education informatization and a series of indicators related to informatization teaching at home and abroad; secondly, we conduct a comprehensive analysis of the various evaluation standards and related indicators of informatization teaching that have been obtained; finally, the process in each indicators is discussed and revised by experts and relevant information technology teachers, and a number of schools are selected to conduct small-scale experimental evaluation experiments to form information-based teaching evaluation indicators.

## 2. Level of Teaching Ability

*2.1. Network Communication Environment.* The computer network communication architecture is shown in Figure 1. At present, there are different understandings of the concept of high-performance computer networks [11]. Interpreted from the perspective of users, high-performance networks refer to broadband networks that support key business operations and meet user network needs; from the perspective of technical implementation, high-performance networks refer to a high-speed, reliable, safe, and efficient network formed by communication links and switches [12]. For the concept of high-performance networks, there are currently no strict bandwidth standards. Compared with traditional networks, high-performance networks have significant advantages in terms of network line performance, network equipment performance, network server performance, and network resource performance [13]. The teaching network communication environment is shown in Figure 1.

*2.2. Comprehensive Evaluation of Teaching Ability Level.* Teaching ability is a reflection of the teachers' psychological characteristics. It is the process of output through the teacher's explicit language and body movements, and finally, the expression process is completed by the learner's acceptance or learning effect [14]. For the evaluation of teaching ability, due to the vagueness of the evaluation content boundary, it is impossible for the evaluator to give a clear numerical judgment, and the advantage of fuzzy mathematics lies in the ability to use more accurate mathematical language to quantitatively describe this fuzzy features. For this reason, combining fuzzy mathematics to establish a multilevel fuzzy comprehensive evaluation system of teaching ability, by constructing a scientific index system and using certain mathematical tools, it can make a more objective reflection of teaching ability, which has good feasibility [15]. On the whole, teaching ability includes three aspects: teaching design, teaching organization and management, and teaching inspection, and each aspect is composed of multiple subabilities. It is a collection of multiple abilities in one aspect, forming a grade division of teaching ability. The different abilities in each level are "tree-shaped" together to form the hierarchical structure of the teaching ability system [16, 17]. Suppose there are $M$ indicators at a certain level (or a set of subindices) in the indicator system,

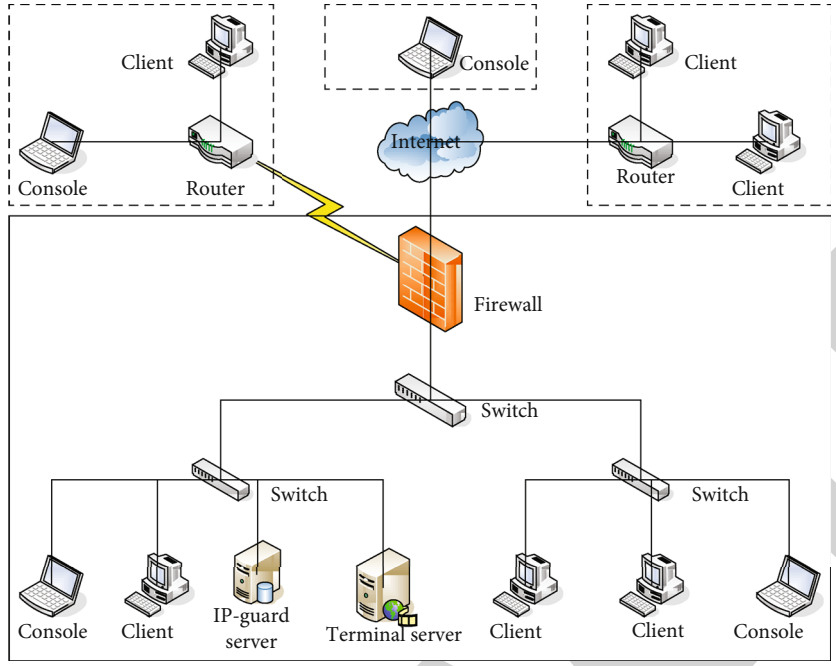


Figure 1: Teaching network communication environment.

and $P$ experts are invited to comment. After the organizer received the comments of experts, the following statistical analysis was carried out [18]:

$$\tilde{E}_i = \frac{1}{p}\sum_{j=1}^{5} E_j n_{ij}. \tag{1}$$

In the formula, $\tilde{E}_i$ represents the concentration of expert opinions on the $i$th index. $E_j$represents the magnitude of the $j$th level of importance of index $i$ [19]. $n_{ij}$ represents the number of experts who rated the $i$th index as the $j$th level of importance [20]. The degree of dispersion is as follows:

$$\delta_i = \sqrt{\frac{1}{p-1}\sum_{j=1}^{5} n_{ij}\left(E_j - \tilde{E}_i\right)}. \tag{2}$$

In the formula, $\delta_i$ represents the degree of dispersion in the evaluation of the importance of the $i$th index by experts, and the larger the $\delta_i$, the lower the reliability of the index [21]. The judgment matrix $A$ is [22–26]

$$A = \begin{pmatrix} a_{11} & a_{12} & \cdots & a_{1n} \\ a_{21} & a_{22} & \cdots & a_{2n} \\ \vdots & \vdots & \vdots & \vdots \\ a_{n1} & a_{n2} & \cdots & a_{nn} \end{pmatrix} = \left(a_{ij}\right)_{n\times n}. \tag{3}$$

In the formula, $a_{ij} = 1(i = j), a_{ij} = 1/a_{ji}$. Normalize the columns of the judgment matrix $A$ [27]:

$$\bar{a}_{ij} = \frac{a_{ij}}{\sum_{k=1}^{n} a_{kj}}, \ (i, j, = 1, 2, \cdots, n). \tag{4}$$

Find the sum $\bar{w}_i$ of the elements in each row of the judgment matrix $A$ [28, 29]:

$$\bar{w}_i = \sum_{j=1}^{n} \bar{a}_{ij} (i = 1, 2, \cdots, n). \tag{5}$$

Normalize $\bar{w}_i$ to get $\bar{w}_i$ [30]:

$$w_i = \frac{\bar{w}_i}{\sum_{j=1}^{n} \bar{w}_i}, \ (i = 1, 2, \cdots, n). \tag{6}$$

Using geometric average method to find the largest eigenvalue of matrix $A$ and its corresponding eigenvector, the formula is [31, 32]

$$\lambda_{\max} w = \frac{1}{n}\sum_{i=1}^{n} \frac{(Aw)_i}{w_i} = \frac{1}{n}\sum_{i=1}^{n} \frac{\sum_{j=1}^{n} a_{ij} w_j}{w_i}, \tag{7}$$

where $(Aw)_i$ represents the $i$th component of the vector $Aw$. Suppose the weights of $m$ targets in the system are different, and the weight vector is [33]

$$W = (w_1, w_2, \cdots, w_m)^T, \ \sum_{i=1}^{m} w_i = 1. \tag{8}$$

Assuming that the relative membership degree of decision $j$ to the best is represented by $u_j$, the fuzzy optimization model of the unit system is deduced as [34, 35]

$$u_j = \frac{1}{1 + \left\{ \left( \sum_{i=1}^{m} \left[ wi\left(g_i - r_{ij}\right) \right]^p \right) / \left( \sum_{i=1}^{m} \left[ wi\left(r_{ij} - b_i\right) \right]^p \right) \right\}^{2/p}}. \tag{9}$$

Among them, $p$ is the distance parameter, when $p = 1$ is the Hamming distance, and when $p = 2$ is the Euclidean distance [36]. The number of hidden layer nodes is equal to the standard pattern number $C$, and its size can be determined according to the sample size. For the convenience of presentation, the hidden layer nodes are expressed by $h$. The standard pattern vector is [37]:

$$S = (s_1, s_2, \cdots, s_c). \tag{10}$$

The activation function of the hidden layer of the network is a fuzzy pattern recognition model, and its expression is as follows [38]:

$$u_{hj} = \frac{1}{\sum_{k=1}^{c} \left( \sum_{i=1}^{m} \left[ w_{ih}\left(u_{ij} - s_h\right) \right]^2 / \sum_{i=1}^{m} \left[ w_{ih}\left(u_{ij} - s_k\right) \right]^2 \right)}, \tag{11}$$

where $w_{ih}$ is the weight of the output of the input layer node $i$ to the input of the hidden layer node $h$, and $j$ is the sample number. The activation function of the network output node $p$ adopts the fuzzy optimization model, and its expression is as follows [39]:

$$u_{pj} = \frac{1}{1 + \left[ \left( \sum_{h=1}^{c} w_{hp} u_{hj} \right)^{-I} - 1 \right]^2} = \frac{1}{1 + \left[ I_{pi}^{-1} - 1 \right]^2}, \tag{12}$$

where $w_{hp}$ is the connection weight of the hidden layer node $h$ and the output layer node $p$, and $j$ is the sample number. The actual output $u_{pj}$ of the network is the response of the fuzzy neural network to the input sample set $(r_{1j}, r_{2j}, \cdots, r_{ij}, \cdots, r_{mj})$. Suppose the expected output of sample $j$ is $a_j$, then its square error is [40]:

$$E = \frac{1}{2n} \sum_{j=1}^{n} E_j = \frac{1}{2n} \sum_{j=1}^{n} \left[ u_{pj} - a_j \right]^2. \tag{13}$$

## 3. Comprehensive Evaluation Experiment for Teaching Ability Level

*3.1. Theoretical Framework of Informatization Teaching Ability Index.* Teaching ability is composed of a series of subabilities related to each link of teaching. The division of each subability is based on the actual operation process of the teacher in the classroom, that is, the cognition, operation, and monitoring of the teaching system elements such as teaching goals, students, strategies, methods, media, and processes.

General teaching ability includes not only the teaching cognition ability of learning objects, learning goals, learning strategies and methods but also the teaching operation ability to solve practical problems in order to achieve the expected goals and also include the ability to ensure the smooth progress of the entire teaching activity monitoring capabilities. It is a complete teaching process related to actual teaching activities, involving the preparation, implementation, coordination, and feedback of teaching. From the perspective of the entire teaching process, the cognitive ability of teaching corresponds to the ability of teaching design, that is, the relevant design of teaching and learning, such as teaching plans, preparation of teaching aids, and learning environment design; and the ability of teaching operation is to the entire teaching specific implementation of the process planning corresponds to the teaching implementation ability; the teaching monitoring ability includes the teacher's adjustment and control of each link of the teacher's teaching and the student's learning, as well as the real-time evaluation according to their own teaching and students' learning situation. This research separately extracted the teaching evaluation ability, integrated planning and preparation into teaching design, and integrated control and adjustment and reflection and correction into teaching implementation. Specific subject teaching ability is based on a specific subject, showing a more specific ability. Compared with traditional subject abilities, the ability of teachers to use various technologies to carry out teaching and research is more in line with the requirements for teachers' abilities in the information age. This ability is different. Teachers in colleges and universities pay more attention to academic research, so they are summarized as information teaching research ability. Informationized real-time teaching is shown in Figure 2.

*3.2. Decomposition of Informatization Teaching Ability Index*

(1) Professional foundation

The professional foundation includes the concept of informatization teaching, the basic knowledge of informatization teaching, and the basic skills of informatization teaching.

(2) Informatization teaching design ability

Based on the above analysis, this research combines the analysis and standards of relevant literature and believes that the ability of informatization teaching design includes learning content analysis ability, learner characteristic analysis ability, teaching goal analysis ability, teaching strategy design ability, learning situation design ability, and learning resource designing ability.

(3) Informatization teaching implementation and monitoring ability

The ability to implement informatization teaching includes communication and collaboration ability, emergency incident handling ability, classroom organization and management ability, classroom control and adjustment ability, and after-class reflection and correction ability.

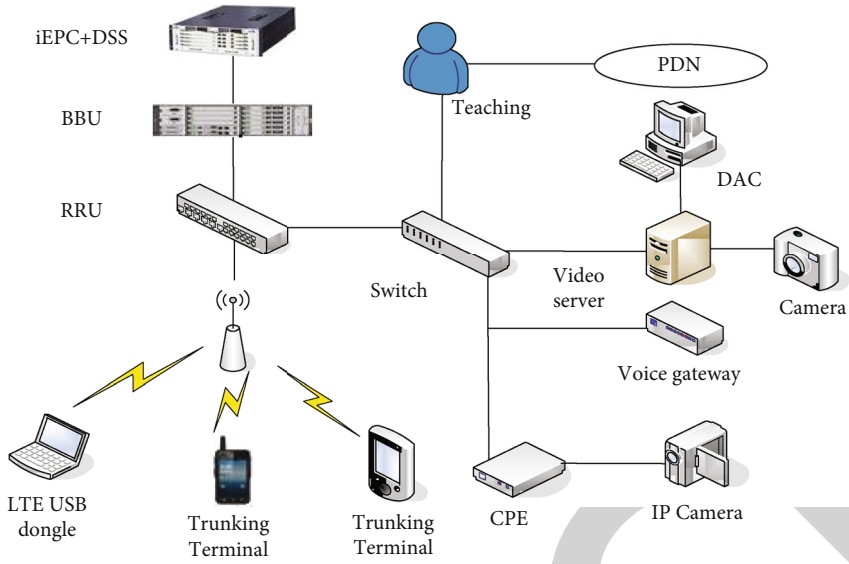


Figure 2: Informationized real-time teaching.

(4) Informatization teaching evaluation ability

Informatization teaching evaluation capabilities include the ability to design evaluation programs, the ability to use evaluation methods, the ability to use evaluation feedback, the ability to interpret evaluation results, and the ability to communicate and use evaluation results.

(5) Informatization teaching and research ability

Informatization teaching research capabilities include after-school reflection and development capabilities, educational action research capabilities, and lifelong learning capabilities.

Based on the above analysis, it is believed that informatization teaching ability includes five dimensions: professional foundation, informatization teaching design ability, informatization teaching implementation and monitoring ability, informatization teaching evaluation ability, and informatization teaching research ability. The informatization teaching and research capabilities are shown in Table 1.

*3.3. Fuzzy Comprehensive Evaluation.* There are many ways to evaluate the system, and for the information teaching system, because there are many factors that are difficult to clearly define in the system, this article uses the fuzzy comprehensive evaluation method to comprehensively evaluate the system.

(1) Establishment of evaluation indicators for informatization teaching

Firstly, we obtain the representative evaluation standards of education informatization and a series of indicators related to informatization teaching at home and abroad; secondly, we conduct a comprehensive analysis of the various evaluation standards and related indicators of informatization teaching obtained in education informatization and analyze the various options in the standards. We use the CIPP model to classify and process and strive to make the indicators not only conform to the development law of education informatization but also reflect the development of informatization teaching from different angles; finally, the processed indicators are revised through the discussion of experts and relevant information technology teachers.

(2) Informatization teaching evaluation index composition

This includes six aspects: informatization strategy, informatization environment construction, management and service, informatization application, informatization talents, and teaching effect.

(1) Information strategy

This indicator has three secondary indicators to measure: the information system, the informatization leadership of the principal, and the informatization construction funding.

(2) Information environment construction

The implementation of the system is inseparable from the support of the environment. The guarantee for the smooth implementation of informatization teaching not only includes the perfect construction of infrastructure and network but also, more importantly, the construction of informationization resource database. If infrastructure and network facilities are blood vessels, then the information resource bank is the blood flowing in it. Advanced infrastructure and complete network configuration ensure the high-speed circulation and sharing of information resources. A good campus informatization atmosphere is an umbrella to promote the healthy development of informatization. Therefore, the construction of informatization environment includes four items: infrastructure, network facilities,

Table 1: Informatization teaching and research capabilities.

| First level indicator | Secondary indicator | |
|---|---|---|
| Professional foundation | Information teaching concept | Basic skills informatization teaching |
| | Basic knowledge of information teaching | — |
| Informatization teaching design ability | Learning content analysis ability | Teaching strategy design ability |
| | Learner analysis ability | Create learning situations |
| | Teaching objective analysis ability | Learning resource design ability |
| Informationized teaching implementation and monitoring capabilities | Communication and collaboration skills | Classroom control and adjustment ability |
| | Resilience | Classroom reflection and correction |
| | Classroom organization and management | — |
| Informatization teaching evaluation ability | Design and evaluation program capacity | Interpretation of evaluation results |
| | Ability to use evaluation methods | Communicate and use evaluation results |
| | Use evaluation feedback capabilities | |
| Informatization teaching research ability | After class reflection and development ability | Educational action research capabilities |
| | Lifelong learning ability | — |

Table 2: Investigation of experimental results.

| Completely changed | | Partial change | | No change | |
|---|---|---|---|---|---|
| Number of people | Proportion (%) | Number of people | Proportion (%) | Number of people | Proportion (%) |
| 7 | 6.0 | 104 | 89.7 | 5 | 4.3 |



informatization resource database, and campus informatization atmosphere.

(3) Management and service

Management is the guarantee for the healthy development of a system, regulating and coordinating the relationship between various elements from all aspects; service is the external manifestation of system function, and the quality of service measures the function of the system. This indicator is achieved through three items: information management system, information service, and interaction between students and parents.

(4) Information application

Informatization application is an important indicator of the evaluation of informatization teaching system. It embodies an achievement of school informatization teaching, which is mainly manifested in the use of teacher and student information tools and the utilization rate of information resource library.

(5) Information talents

The level of informatization and educational technology of teachers is related to the quality and effectiveness of classroom teaching. The penetration rate of information skills and the application of informatization teaching models are also related to the effectiveness of classroom teaching. This item is determined by professionals, information skills, penetration rate, and information, four secondary indicators for the application of chemical technology education and informatization teaching mode.

(6) Teaching effect

The ultimate goal of the information teaching system is to cultivate students' information literacy, especially information ability, so the teaching effect is composed of students' information knowledge, professional ability, and information ability.

(3) Single-factor membership determination

Mainly by issuing questionnaires to middle school teachers, using self-evaluation method, the evaluation results are given according to the set five levels, and the corresponding fuzzy evaluation matrix is obtained. In this study, the proportion method is used to calculate the membership degree of each observation index based on the recovered data and establish the fuzzy relationship matrix of each evaluation factor.

*3.4. Determination of Weight.* The weight reveals the value difference of the corresponding index to the effect of

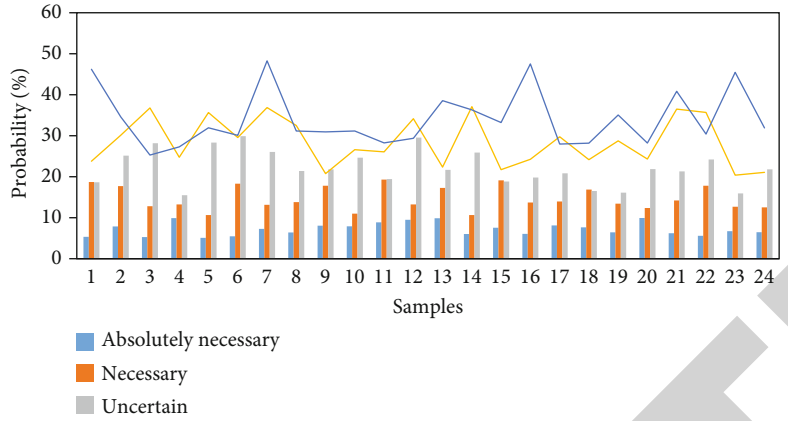


Figure 3: Teaching in a communication and information environment.

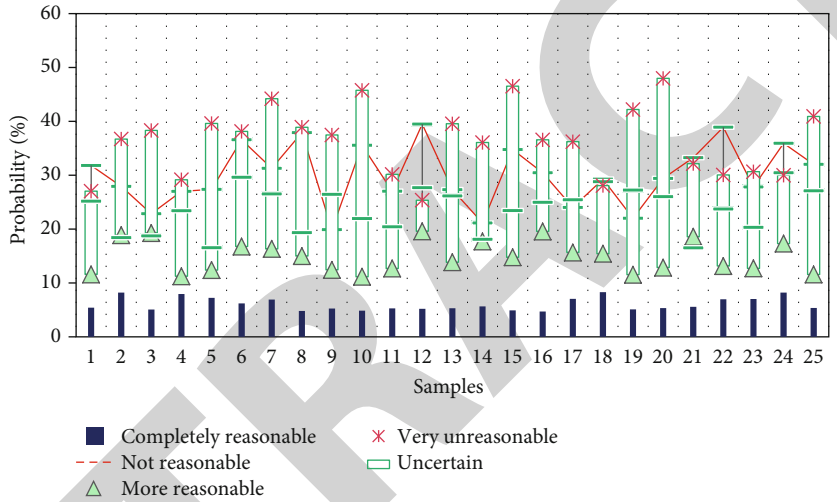


Figure 4: Job rationality investigation.



informatization teaching. It tries its best to reveal the difference in the status and function of the index through the form of numerical value. People pay attention to the level of index weight, so as to guide the development direction of informatization teaching and promote the healthy development of informatization teaching. This is the value guiding role of weight.

*3.5. Determining Weight.* The objective weight determination method requires a large amount of mathematical statistical data support to obtain statistical characteristics and then obtain the weight of each indicator. Since the evaluation index system of informatization teaching is a personal research, this method is obviously not objective and difficult to achieve; for subjective weights and the Gulin method in the determination method, the key to the evaluation is the determination of the relative importance multiple ($Rj$) of the evaluation object. Since the value of $Rj$ is completely subjectively determined by experts, it is often difficult to accurately give, so the Gulin method is not a practical method; The Philippine law uses an anonymous method to solicit the opinions of the expert group members. After several rounds of consultation, the opinions of the expert group are converged. Finally, statistics are calculated to calculate the weight. This method requires several rounds of consultation with experts. It is quite difficult to operate, so this article uses expert scoring method combined with analytic hierarchy process to determine the weight in the evaluation index system.

## 4. Results and Discussion

Based on the impact of the development and changes of network communication tools on teaching, especially the changes brought about by interaction, this research theoretically explores the characteristics of teacher-student interaction changes in the network communication environment and constructs the teacher-student interaction environment in the network communication environment. The investigation of the experimental results is shown in Table 2. Nearly 90% of the survey respondents believe that the application of information technology in teaching can partially change

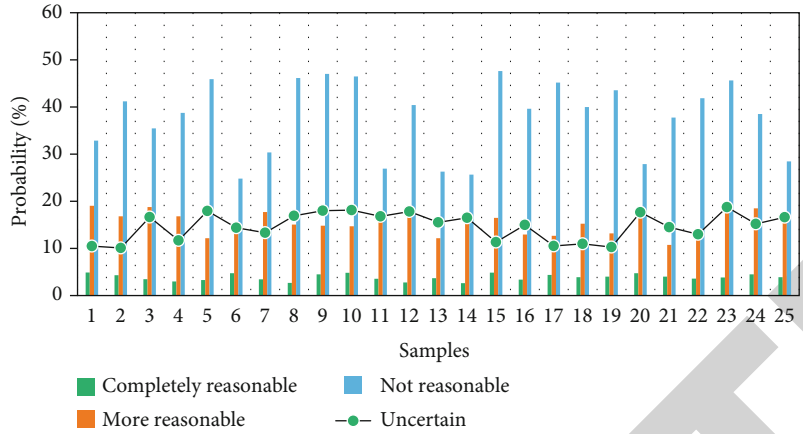


Figure 5: Teaching resources provided by teachers in teaching.

Table 3: Each level of teacher's comment set of information teaching ability.

| Dimension | Difference | Poor | Excellent |
|---|---|---|---|
| Professional foundation of information teaching | 0.00 | 0.05 | 0.09 |
| Informatization teaching design ability | 0.01 | 0.08 | 0.04 |
| Informationized teaching implementation and monitoring capabilities | 0.00 | 0.08 | 0.03 |
| Informatization teaching evaluation ability | 0.01 | 0.04 | 0.03 |
| Informatization teaching research ability | 0.00 | 0.03 | 0.06 |
| Informatization teaching ability | 0.005 | 0.057 | 0.053 |

Table 4: Teachers' informatization teaching score.

| Between groups | Between groups | Sum of square | DF |
|---|---|---|---|
| Gender | Between groups | 28.749 | 82 |
| | Within group | 1779.91 8 | 83 |
| | Total | 1808.667 | 3 |
| Teaching age | Between groups | 250.145 | 80 |
| | Within group | 1558.521 | 83 |
| | Total | 1808.667 | 79 |
| Job title | Between groups | 207.227 | 83 |
| | Within group | 1601.439 | 3 |
| | Total | 1808.667 | 80 |
| Area | Between groups | 35.619 | 33 |
| | Within group | 1773.048 | 2 |
| | Total | 1808.667 | 81 |

Table 5: Informatization teaching design ability.

| Between groups | Between groups | Sum of square | DF |
|---|---|---|---|
| Gender | Between groups | 11.771 | 82 |
| | Within group | 4280.467 | 3 |
| | Total | 4292.238 | 3 |
| Teaching age | Between groups | 616.646 | 80 |
| | Within group | 3675.592 | 83 |
| | Total | 4292.238 | 4 |
| Job title | Between groups | 88.132 | 79 |
| | Within group | 4204.106 | 83 |
| | Total | 4292.238 | 80 |
| Area | Between groups | 292.579 | 33 |
| | Within group | 3999.659 | 81 |
| | Total | 4292.238 | 83 |

the teaching methods. 6% of teachers even think that teaching methods can be completely changed. Only 4.3% of teachers believe that teaching methods cannot be changed.

With the rapid development of network communication technology, the rapid popularization of interactive communication tools and software such as video conferencing systems, instant messaging software, mobile communication platforms, and their functions are becoming more and more conducive to teacher-student interaction, making teacher-student interactions more complex and diverse. 45.5% of students believe that homework is necessary. Therefore, it is reasonable and necessary for most students to study and assess the design of the information chemistry teaching program. Questionnaire survey data show that only 18.2% of people think homework is unnecessary, and most of these students are math majors. Later, interviews also found that they thought that they did not have time to complete the design of the learning work, so they hope that the less homework the teacher will assign, the better. This is also the identification of students with the evaluation method of learning works. The teaching evaluation method of preservice teacher informatization teaching ability training needs to change from the traditional method to the diversified evaluation method. The teaching under the communication information environment is shown in Figure 3.

The questionnaire data survey on the rationality of homework shows that 18.2% of the students think it is completely reasonable, and 36.4% of the students think it is more reasonable. In other words, more than half of the

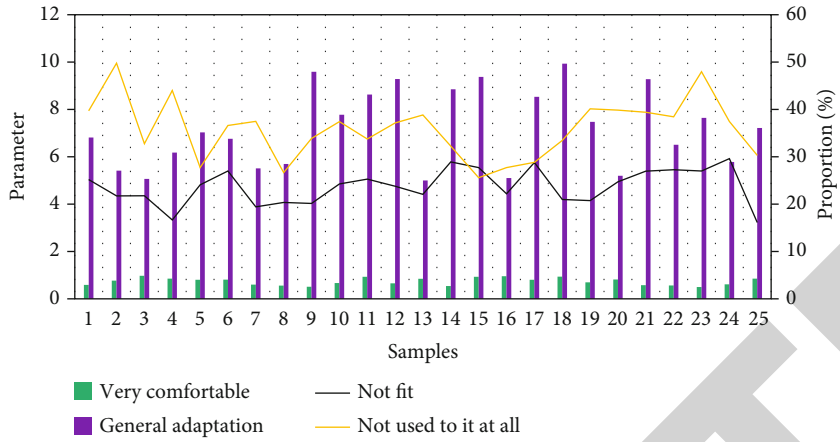


Figure 6: Learning adaptation in the online teaching platform.

students think the homework is reasonable. However, 18.2% of students think that the homework is very unreasonable, and they have obvious opposition to the homework. The operation rationality investigation is shown in Figure 4.

According to the questionnaire survey data on the teaching resources provided by teachers, only 19.3% of students believe that the teaching resources prepared by teachers are not sufficient. The teaching resources provided by teachers in teaching are shown in Figure 5.

The ratio of each level of the teacher's informatization teaching ability comment collection is as follows: "bad 0.5%," "poor 5.7%," "general 35.3%," "good 53.1%," and "excellent 5.3%", at the "good" level between the two and the "average" level, and the relative bias toward the "good" level. If judged according to the principle of maximum degree of membership, the overall level of middle school teachers in this area is at a "good" level. To sum up, it shows that the overall level of teachers' overall information teaching ability is not high. Table 3 shows the proportion of each level of the teacher's information-based teaching ability comment collection.

The scores of teachers' informatization teaching are shown in Table 4. The comprehensive evaluation results show that the basic score of the information teaching specialty of middle school teachers is 3.81 points, which is a "good" level. The statistical results from the analysis of variance show that the statistical value $p$ of gender and professional title in this dimension of the information-based teaching major is not less than 0.05, and there is no significant difference; teachers in different regions have significant differences in the basic dimensions of the information-based teaching major, and the results are compared afterwards. It shows that the $p$ value of teachers in urban and rural schools is less than 0.05, and the difference between the two is significant, and the professional basic score of the former is relatively better than the latter; different teaching ages have significant differences in the basic dimensions of informatization teaching, and the results of the postcomparison show 5. There is a significant difference between the teachers of 9 years and more than 15 years, and the score of the former is higher than that of the latter.

Table 6: Informatization teaching and research capabilities.

| Between groups | Groups | Sum of square | DF |
|---|---|---|---|
| Gender | Between groups | 0.001 | 1 |
| | Within group | 1462.57 | 83 |
| | Total | 1462.571 | 3 |
| Teaching age | Between groups | 221.175 | 80 |
| | Within group | 1241.396 | 83 |
| | Total | 1462.571 | 4 |
| Job title | Between groups | 25.92 | 79 |
| | Within group | 1436.652 | 83 |
| | Total | 1462.571 | 81 |
| Area | Between groups | 76.757 | 83 |
| | Within group | 4076.214 | 32 |
| | Total | 4576.667 | 83 |

The ability of the informatization teaching design is shown in Table 5. According to the comprehensive evaluation results, the informatization teaching design ability is not ideal, and the score is the lowest, only 3.44 points. The statistical results from the analysis of variance show the statistical value $p$ of gender. The postcomparison results show that 5 average difference between the two groups over 9 years and 15 years is significant, and the score of the former is higher than that of the latter; the difference between teachers in different regions is significant. After the comparison, the teachers and teachers in the city where the school is located are compared with the school office. There is a significant difference between rural and urban teachers ($p < 0.05$), and the scores of teachers whose school is located in cities are significantly higher than those of rural and urban teachers.

The questionnaire survey data on the learning adaptation in the online teaching platform shows that 25.3% of the students said they are very suitable for learning on the online teaching platform, and 62.7% of the students said they are more adapted to learning in this environment, with only 1.2% of the students. I think it is not suitable for learning on the online teaching platform. However, this semester

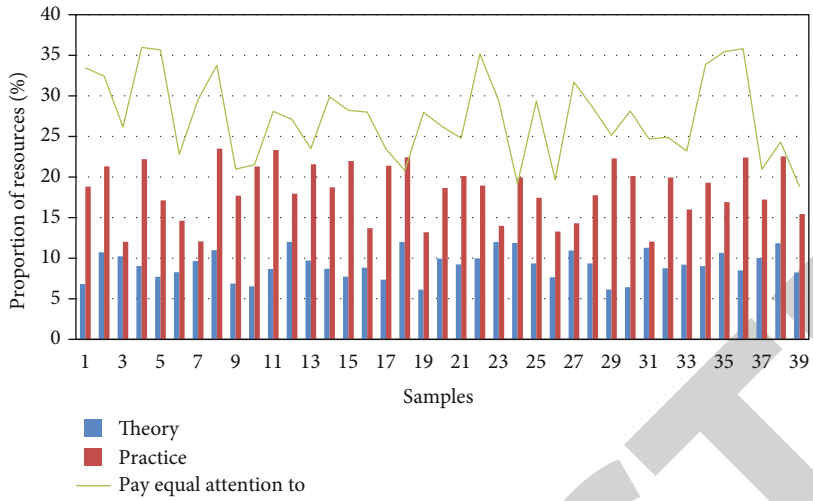


Figure 7: Type bias of teaching resources.

network teaching platform has not been effectively used due to some objective reasons such as servers. The learning adaptation in the network teaching platform is shown in Figure 6.

The informatization teaching and research capabilities are shown in Table 6. The statistical results from the analysis of variance show that teachers of different teaching ages have significant differences in this dimension. After comparison, there is a significant difference between the two teacher groups ($p < 0.05$) between 5 and 9 years and more than 15 years, and the teachers of 5-9 years are equally divided. More than 15 years; the statistical value $p$ of gender, job title, and title in this dimension is not less than 0.05, and there is no significant difference; the difference between teachers in different regions is significant, and after comparison, teachers whose schools are in cities are compared with those in rural areas and schools where they are located. There is a significant difference between teachers in urban areas and teachers in rural areas ($p < 0.05$). The scores of teachers in cities where the school is located are higher than those in urban areas, and teachers in urban areas where the school is located have higher scores than teachers in rural areas. The existence of the network communication environment, compared with the traditional teaching in the past, has improved the students' independent learning ability and increased the share of knowledge, laying a solid foundation for the development of independent working ability, scientific research ability, and other abilities.

The type bias of teaching resources is shown in Figure 7. The results of the survey on the bias of the existing teaching resource types show that the students' understanding of the bias of the existing teaching resources is not very clear, and different students have different understandings. From the other side, it reflects that the bias of resources is not obvious. Therefore, the construction of online teaching resources for preservice teachers' informatization ability training should have a clearer direction or bias, so as to better serve the teaching of teachers directly, so as to effectively promote the development of relevant abilities of students. Autonomous learning based on network resources is the application of computer network technology in pedagogy. It is an emerging technology based on computer science, pedagogy, psychology, behavioral science and other disciplines. It uses computer networks as the carrier of teaching information, combines computer network technology with multimedia technology and modern teaching equipment, so that learners are transformed from passive receivers of knowledge to active builders of knowledge. Compared with traditional teacher teaching, it has changed linear teaching mode of traditional teachers' classroom; teaching is transformed into a nonlinear autonomous learning mode in which learners break through the limitations of time and space.

## 5. Conclusion

This research mainly discusses the comprehensive evaluation of the teaching ability level based on the network communication environment. This study uses a fuzzy comprehensive evaluation method to comprehensively evaluate the system. First, we obtain the representative evaluation standards of education informatization and a series of indicators related to informatization teaching at home and abroad; secondly, we conduct a comprehensive analysis of the various evaluation standards and related indicators of informatization teaching that have been obtained; finally, the process of each indicator is discussed and revised by experts and relevant information technology teachers, and a number of schools are selected to conduct small-scale experimental evaluation experiments to form information-based teaching evaluation indicators. The ultimate goal of the information teaching system is to cultivate students' information literacy, especially information ability, so the teaching effect is composed of students' information knowledge, professional ability, and information ability. This research will help promote the improvement of school teaching quality. The information society puts forward new requirements for teachers' professional development and knowledge structure and ability and quality. It focuses on training and improving teachers' information teaching ability and quality, so that teachers can understand how to

better use information technology in education and teaching. It is an information society. The inevitable choice of teachers' professional development is the need to conform to the trend of educational development.

## Data Availability

The data that support the findings of this study are available from the corresponding author upon reasonable request.

## Disclosure

And all authors have seen the manuscript and approved to submit to your journal.

## Conflicts of Interest

There are no potential competing interests in our paper.

## References


[1] S. Liu, "Fuzzy evaluation method of teachers' informationized teaching ability," *IOP Conference Series: Materials Science and Engineering*, vol. 750, article 012079, 2020.

[2] Y. Sun, H. Song, A. J. Jara, and R. Bie, "Internet of Things and big data analytics for smart and connected communities," *IEEE Access*, vol. 4, pp. 766–773, 2016.

[3] Z. P. Cai and Z. Xu, "A private and efficient mechanism for data uploading in smart cyber-physical systems," *IEEE Transactions on Network Science and Engineering (TNSE)*, vol. 7, no. 2, pp. 766–775, 2020.

[4] N. Xiao, R. Xinyi, Z. Xiong et al., "A diversity-based selfish node detection algorithm for socially aware networking," *Journal of Signal Processing Systems*, vol. 93, no. 7, pp. 811–825, 2021.

[5] J. Liu, N. Kato, J. Ma, and N. Kadowaki, "Device-to-device communication in LTE-advanced networks: a survey," *IEEE Communications Surveys & Tutorials*, vol. 17, no. 4, pp. 1923–1940, 2015.

[6] E. E. Tsiropoulou, G. Mitsis, and S. Papavassiliou, "Interest-aware energy collection & resource management in machine to machine communications," *Ad Hoc Networks*, vol. 68, pp. 48–57, 2018.

[7] C. Hu, H. Li, Y. Huo, T. Xiang, and X. Liao, "Secure and efficient data communication protocol for wireless body area networks," *IEEE Transactions on Multi-Scale Computing Systems*, vol. 2, no. 2, pp. 94–107, 2016.

[8] Z. Xu and Z. P. Cai, "Privacy-preserved data sharing towards multiple parties in industrial IoTs," *IEEE Journal on Selected Areas in Communications (JSAC)*, vol. 38, no. 5, pp. 968–979, 2020.

[9] M. Jahanbakht, W. Xiang, L. Hanzo, and M. Rahimi Azghadi, "Internet of underwater things and big marine data analytics – a comprehensive survey," *IEEE Communications Surveys & Tutorials*, vol. 23, no. 2, pp. 904–956, 2021.

[10] W. Feng, Y. Wang, D. Lin, N. Ge, J. Lu, and S. Li, "When mmWave communications meet network densification: a scalable interference coordination perspective," *IEEE Journal on Selected Areas in Communications*, vol. 35, no. 7, pp. 1459–1471, 2017.

[11] X. J. Li, Y. H. Liu, P. J. Liu et al., "Application of computer vision technologies in collecting HVAC control signals," *HV & AC (Chinese Journal)*, vol. 51, no. 6, pp. 1–12, 2021.

[12] Z. P. Cai, Z. B. He, X. Guan, and Y. S. Li, "Collective data-sanitization for preventing sensitive information inference attacks in social networks," *IEEE Transactions on Dependable and Secure Computing*, vol. 15, no. 4, pp. 577–590, 2018.

[13] R. Amorim, H. Nguyen, P. Mogensen, I. Z. Kovacs, J. Wigard, and T. B. Sorensen, "Radio channel modeling for UAV communication over cellular networks," *IEEE Wireless Communications Letters*, vol. 6, no. 4, pp. 514–517, 2017.

[14] B. Yang, X. Li, Y. Z. Hou et al., "Non-invasive (non-contact) measurements of human thermal physiology signals and thermal comfort/discomfort poses -a review," *Energy and Buildings*, vol. 224, article 110261, 2020.

[15] S. Yang, X. Wei, B. Deng, C. Liu, H. Li, and J. Wang, "Efficient digital implementation of a conductance-based globus pallidus neuron and the dynamics analysis," *Physica A: Statistical Mechanics and its Applications*, vol. 494, pp. 484–502, 2018.

[16] A. Nedic, A. Olshevsky, and T. M. G. Rab Ba, "Network topology and communication-computation tradeoffs in decentralized optimization," *Proceedings of the IEEE*, vol. 106, no. 5, pp. 953–976, 2018.

[17] X. Zhang, Q. Gao, C. Gong, and Z. Xu, "User grouping and power allocation for NOMA visible light communication multi-cell networks," *IEEE Communications Letters*, vol. 21, no. 4, pp. 777–780, 2017.

[18] N. Zlatanov, R. Schober, and Z. Hadzi-Velkov, "Asymptotically optimal power allocation for energy harvesting communication networks," *IEEE Transactions on Vehicular Technology*, vol. 66, no. 8, pp. 7286–7301, 2017.

[19] T. K. Vu, C. F. Liu, M. Bennis, M. Debbah, M. Latva-aho, and C. S. Hong, "Ultra-reliable and low latency communication in mmWave-enabled massive MIMO networks," *IEEE Communications Letters*, vol. 21, no. 9, pp. 2041–2044, 2017.

[20] R. Radhakrishnan, W. W. Edmonson, F. Afghah, R. M. Rodriguez-Osorio, F. Pinto, and S. C. Burleigh, "Survey of inter-satellite communication for small satellite systems: physical layer to network layer view," *IEEE Communications Surveys & Tutorials*, vol. 18, no. 4, pp. 2442–2473, 2016.

[21] Y. Luo, P. Hong, R. Su, and K. Xue, "Resource allocation for energy harvesting-powered D2D communication underlaying cellular networks," *IEEE Transactions on Vehicular Technology*, vol. 66, no. 11, pp. 10486–10498, 2017.

[22] T. A. Eriksson, H. Bulow, and A. Leven, "Applying neural networks in optical communication systems: possible pitfalls," *IEEE Photonics Technology Letters*, vol. 29, no. 23, pp. 2091–2094, 2017.

[23] G. Wang, X. Chen, H. Guo, and C. Zhang, "Region ensemble network: towards good practices for deep 3D hand pose estimation," *Journal of Visual Communication and Image Representation*, vol. 55, pp. 404–414, 2018.

[24] X. J. Cheng, S. P. Wan, J. Y. Dong, and L. Martínez, "New decision-making methods with interval reciprocal preference relations: a new admissible order relation of intervals," *Information Sciences*, vol. 569, pp. 400–429, 2021.

[25] S. P. Wan, H. W. Yuan, and J. Y. Dong, "Decision making with incomplete interval multiplicative preference relations based on stochastic program and interval category," *Information Sciences*, vol. 570, pp. 403–427, 2021.

[26] S. Wan, X. Cheng, C. Chen, and J. Dong, "L-R geometric consistency definition of triangular multiplicative preference relation in group decision making," *Fuzzy Sets and Systems*, vol. 409, pp. 85–113, 2021.

[27] A. Douik, S. Sorour, T. Y. al-Naffouri, and M. S. Alouini, "Instantly decodable network coding: from centralized to device-to-device communications," *IEEE Communications Surveys & Tutorials*, vol. 19, no. 2, pp. 1201–1224, 2017.

[28] A. Abrardo and M. Moretti, "Distributed power allocation for D2D communications underlaying/overlaying OFDMA cellular networks," *IEEE Transactions on Wireless Communications*, vol. 16, no. 3, pp. 1466–1479, 2017.

[29] G. S. Paschos, G. Iosifidis, M. Tao, D. Towsley, and G. Caire, "The role of caching in future communication systems and networks," *IEEE Journal on Selected Areas in Communications*, vol. 36, no. 6, pp. 1111–1125, 2018.

[30] S. Y. Deng and X. Que, "Research on the teaching assessment of students of science and engineering teachers in a university," *Computer Applications in Engineering Education*, vol. 27, no. 1, pp. 5–12, 2019.

[31] A. Lino, Á. Rocha, and A. Sizo, "Virtual teaching and learning environments: automatic evaluation with artificial neural networks," *Cluster Computing*, vol. 22, no. 4, pp. 1–11, 2017.

[32] D. Zou, "Vocabulary acquisition through cloze exercises, sentence-writing and composition-writing: extending the evaluation component of the involvement load hypothesis," *Language Teaching Research*, vol. 21, no. 1, pp. 54–75, 2017.

[33] D. Godish, R. Miltenberger, and S. Sanchez, "Evaluation of video modeling for teaching abduction prevention skills to children with autism spectrum disorder," *Advances in Neurodevelopmental Disorders*, vol. 1, no. 3, pp. 168–175, 2017.

[34] E. Gourdin, D. Medhi, and A. Pattavina, "Design of reliable communication networks," *Annals of Telecommunications*, vol. 73, no. 1-2, pp. 1–3, 2018.

[35] S. A. Vega García, K. K. Stacy-Bates, J. Alger, and R. Marupova, "Peer evaluation of teaching in an online information literacy course," *Portal Libraries and the Academy*, vol. 17, no. 3, pp. 471–483, 2017.

[36] S. Z. Ahmad, A. R. Abu Bakar, and N. Ahmad, "An evaluation of teaching methods of entrepreneurship in hospitality and tourism programs," *The International Journal of Management Education*, vol. 16, no. 1, pp. 14–25, 2018.

[37] F. Garofalo, P. Mota-Moya, A. Munday, and S. Romy, "Total extraperitoneal hernia repair: residency teaching program and outcome evaluation," *World Journal of Surgery*, vol. 41, no. 1, pp. 100–105, 2017.

[38] B. Goswami, A. Jain, and B. C. Koner, "Evaluation of brainstorming session as a teaching-learning tool among postgraduate medical biochemistry students," *International Journal of Applied & Basic Medical Research*, vol. 7, Supplement 1, pp. S15–S18, 2017.

[39] G. Osorio, M. Hoenigl, J. Quartarolo et al., "Evaluation of opt-out inpatient HIV screening at an urban teaching hospital," *AIDS Care*, vol. 29, no. 8, pp. 1014–1018, 2017.

[40] E. C. Muzeyyen and S. A. F. A. K. Pınar, "An evaluation of the preferences of individuals with severe and multiple disabilities and the teaching of choice-making skills," *Educational Research and Reviews*, vol. 12, no. 3, pp. 143–154, 2017.