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Retraction

Retracted: Digital Effectiveness in Video Conference Methods on Internet Learning Environments of Higher Education

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This article has been retracted by Hindawi following an investigation undertaken by the publisher [1].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) Manipulated or compromised peer review

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.

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).

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. Wei and H. Tang, "Digital Effectiveness in Video Conference Methods on Internet Learning Environments of Higher Education," *Journal of Mathematics*, vol. 2022, Article ID 6996407, 6 pages, 2022.

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Research Article

Digital Effectiveness in Video Conference Methods on Internet Learning Environments of Higher Education

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Information and communication technologies, especially modern transmission technologies, for instance, teleconferencing, widely known, provide premium educational and pedagogical opportunities, contributing significantly to the implementation of a collaborative learning environment. That the utilization of video conferencing differs significantly from conventional teaching should be emphasized in a way of leading adaptation to the requirements of the educational environment. In general, the digital efficiency of teleconferencing methods needs to be investigated as a very important factor when it is implemented effectively in online learning environments under the title of modern higher education. This paper has aimed at investigating the ways of effective utilization of video conferencing in an online learning environment and presents a case study following the principles of educational neuroscience and distance education that are related to appropriate utilization of available digital technologies to function as educational and learning means to promote the usage in the framework of higher education.

1. Introduction

Distance education [1] has currently used various digital tools that have been directed to new paths including new principles to meet the needs of contemporary digital life. The most important contribution of the use of technology in learning is the facilitation of communication and the provision of appropriate means so that teachers and learners acquire new communication skills intertwined with modern e-learning environments [2].

Given that communication in the era of digitalization has been transforming educational practices, it is certain that they also affect the learning process by offering more opportunities to exchange ideas, information, and knowledge, but also critical analysis, collaboration, active participation, and access to the worldwide wealth of innovations and ideas. A prerequisite, however, for their effectiveness is the new technologies to be used with a specific design in the learning process, adapted to the personal needs of each learner [3].

One of the most common communication practices in the daily life of modern society, especially in times of pandemics, is teleconferencing [4]. Video conferencing is about real-time audio and video communication between people who are geographically remote and can exchange data, files, and applications. The particular importance for education is the interactive video conference in which participants build knowledge through their active and collaborative participation in a dynamic digital interactive environment.

Teleconferencing resembles the conditions of distance learning that are very close to those of physical learning, providing audiovisual stimuli (verbal and nonverbal) that reduce the isolation of learners. Audiovisual stimuli can enhance the socioemotional interaction of participants with asynchronous ways of communication, promoting their interpersonal relationships and cooperation.

Similar to other ways of e-learning, the application of video conferencing should have a customized and specific

design, utilizing pedagogical criteria to enhance the quality of both learning and teaching processes.

However, teleconferencing has not been particularly investigated either in terms of the pedagogical principles of distance education or at the individual or the group level.

The objective of this paper is to investigate the relationship between theories, principles, and cognitive approaches of audiovisual learning [5]. Besides, perception of the learning process through teleconferencing with the combination of both distance education and learning environments in higher education framework is examined [6]. In particular, both importance of visual perception and learning are highlighted to reduce the perceived interactive distance that enhances the learning process through video conferencing. An appropriate case study examining the practice of the breakout rooms [7, 8] as a tool to optimize participation in terms of knowledge, thoughts, approaches, needs, and feelings for learning is provided.

Therefore, this paper has aimed at investigating the ways of effective utilization of video conferencing in an online learning environment and presents a case study following the principles of educational neuroscience and distance education that are related to appropriate utilization of available digital technologies to function as educational and learning means to promote the usage in the framework of higher education.

The rest of the manuscript is organized as follows: Section 2 is devoted to reviewing the relationship between neuroscience and digital learning concerning the theories developed. Section 3 reviews the issues that existed in the environment of Internet learning concerning the perspective of neuroscience. A case study is presented in Section 4. Section 5 provides a discussion of the findings of the case study. Section 6 presents the conclusion of the research and potential further studies.

2. Neuroscience and Digital Learning

Learning, as a process, has been identified among others by cognitive approaches [9] related to neuroscience that studies the brain and nervous system interdisciplinary, including elements from scientific disciplines such as biology, medicine, psychology, and computer science. Neuroscience combined with the scientific disciplines of education and cognitive psychology forms educational neuroscience [10] that contributes to the comprehensive understanding of the learning process of human beings and leads to the improvement of educational methods and techniques.

The plasticity of the brain is the basic function of the body that serves the learning process in the perspective of neuroscience. The adaptation of the brain to the stimuli of the environment leads to the achievement of learning [11]. More specifically, learning is achieved by devising mental representations through the neuronal activity of the brain. The stimulus of the environment causes the construction of specific synapses in the nerve cells of the brain, which are transformed into movements, senses, emotions, and intellect. This recording of stimuli in connection to neurons is done with both specific pathways and the help of specific organs of the nervous system. The fact that the synapses of nerve cells are altered, additionally or subtractively, also proves the contribution of brain plasticity to human learning.

To achieve learning, specialized centers of the brain work together to coordinate the activities of different neural networks and different brain regions to which different brain functions correspond. Neuroscience approaches learning through perception and memory [12, 13]. Perception is created by transferring sensory stimuli to the brain's memory for processing. Hence, perceptual learning, which refers to the improvement of the individual in distinguishing sensory stimuli, affects his emotions and learning behavior. Ultimately, the stimuli of the environment are filtered by thoughts, ideas, values, habits, attitudes, and feelings to be transformed into perception.

Visual perception, more specifically discussed in [14], is formed through the sensory pathway of vision and refers to the adaptation of the brain to any change in visual reality. It is influenced by specific elements of visual communication such as balance, color, shape, movement, and dimensions of visual elements. It is also governed by specific laws, theories, and principles [15] such as the laws of hierarchy, the Gestalt theory [16], the empiricism theory, the Marr computational theory [17], the Gibson ecological theory, empathy theory [18], and neurophysiological theory. Thus, designing more effective educational learning environments and relevant educational material is contributed by those theories.

The memory of the brain is the focus of the learning process [19] since information is processed and stored or rejected. Information processing theory [20] states that the brain functions in a serial manner like a computer. Sensory information ends up in sensory memory to be transmitted and stored in long-term memory. Shape theory [21] satisfactorily explains the mechanism of information storage in the brain, while contributing to the development of educational techniques that can facilitate learning. "Shapes" are nothing more than cognitive structures (conceptual representations) in which information elements are organized in various ways. While sensory stimuli are processed, the internal representations that the person already has stored in his brain play an important role that defines his psychoemotional state.

The theory of dual coding [22] distinguishes the information that the brain processes into verbal and nonverbal. While verbal stimuli are coded in the form of words, events, ideas, and concepts, nonverbal stimuli are coded as visual, auditory, emotional, and tactile "images." Hence, nonverbal messages can be linked to corresponding verbal messages and construct internal cognitive or mental representations, which are essentially neural circuits created by connections between specific neurons in the brain. The cognitive representations that are created remain inactive until they are activated or consciously connected to some new external information. The result of the variety of connections between verbal and nonverbal information is the empowerment of learning facts, words, and information in the brain. On the other hand, the limited capacity of memory led to the cognitive load theory [23] and the theory of multimedia

learning [24], which suggest ways to maximize its productivity. Cognitive load theory suggests ways to maximize memory productivity while minimizing information that is unrelated to learning objectives or distracting learners. The success of the application of this theory in the learning process depends mainly on the knowledge of the teacher about the cognitive process. Considering the factors affecting negatively the working memory such as the emotional factors and the volume of the teaching material, the appropriate and individualized modification in the types of cognitive loads can be achieved for effective processing of the new information.

The theory of multimedia learning focuses equally on the processing of audiovisual stimuli by the brain. However, it gives special importance to active learning and the involvement of learners in such a way of processing both audiovisual and verbal stimuli during the learning process. This theory suggests that learning becomes more effective when there is a combination of verbal messages and images. Thus, it aims to enhance the cognitive process without overloading the visual or auditory channel through which the corresponding stimuli are processed. The important point is that both theories highlight the importance of proper educational planning and contribute to enhancing learning effectiveness factors that are crucial in distance learning education.

Video conferencing, as a multimedia communication tool, utilizes both audio and video for the interaction of participants. Audiovisual learning theories provide an important medium since teachers can design more effective distance education programs with the help of it. Hence, enhancing audiovisual learning in distance education contributes to the optimal support and guidance of learners and strengthens the learning experience as a way of better knowledge extraction.

The trainer needs to focus on the issues in the context of online learning that can be summarized as follows:

(1) The active participation of the trainees in the learning process

(2) The integration of the evaluation of the trainees in the educational process

(3) The utilization of the teaching barriers of the trainees

(4) The multidimensional approach of both presentation and the activities that will be assigned to the trainees

The teacher's focus on the aforementioned needs should be properly employed when designed and executed in the educational environment.

3. Environments of Internet Learning

The working or learning environment in contemporary e-learning settings plays a crucial role. The findings of educational neuroscience [25–27] suggest that the information captured by the brain is first processed in the parietal system of the brain, which is a neuroanatomical background for the expression and perception of emotional states, mobilization, and the emotional part of the memory process. Long-term memory and learning are significantly affected by this system. Thus, some issues, for instance, stress and threat, in the context of learning have negative effects on learners.

To this end, the learning environment containing positive emotional experiences and connections helps learners contribute to their learning process [28]. The four focused areas were expressed in the previous section, namely, active participation, assessment integration, learning barriers, multidimensional approach. Discussing two more issues related to the work-learning environment became important. While the first issue is called the "speed" with which an online classroom operates, the second concerns the cooperation among learners. The speed with which the online classroom "runs" plays a crucial role in terms of creativity and flexibility. Hence, how learners acquire knowledge from their active participation in the course is thought of significant. The current findings in the field of neuroeducation [29] suggest that working under pressure causes stress and the impression on learners considering that "my mind has stopped working." Therefore, speed affects both learning and the brain.

The research suggests that when learning is undertaken at a fast pace, existing synapses can be strengthened and neural circuits are activated. However, they can weaken just as active participation, integration of assessment, exploitation of didactic barriers are quickly forced. Thus, the multidimensional approach cannot be fully implemented. On the contrary, it seems that learning is enhanced when learners approach concepts and ideas with creativity and flexibility. Therefore, it is suggested that the online learning environment is important to function in such a way of providing learners with the time that they need to be creative. Students need to engage in activities to improve procedural knowledge to reduce the simple reproduction/memorization of information. Thus, lowering the value of speed in online learning is a better approach to take since the development of synapses and neural circuits is a complex and multidimensional process.

Technology contemporarily provides the means for the realization and implementation of online collaborative actions. The ability to utilize virtual rooms is one of the means that can enhance collaboration between learners. In addition, teachers can assign group works by varying the content per group of learners.

In online classrooms, collaborations between learners are important since they allow them to share their concerns and ideas and study the problems successfully that have been assigned. Hence, they help them understand and recognize how other people work. Specifically, a collaboration between learners helps them recognize some or many learning difficulties in the context of learning. Learners will therefore be able to think critically about their learning process and realize how similar or identical problems/obstacles that they experience must be overcome. In addition, learners can make connections and express opinions between ideas, allowing them to explore new ideas and cooperate to solve problems.

The findings in the field of neuroscience [12] suggest that when people work together, the inner cortical cortex and the

frontal cortex network get activated, thus enhancing the development of executive functions. Therefore, these areas of the brain are also referred to as the "social brain" and demonstrate the value of the sociocultural approach to learning and the need to provide students with opportunities for collaboration. Collaboration is, therefore, a complex issue that plays a crucial role in learning, achieving goals, and developing the brain.

Online learning provides a proper framework for collaboration, allowing learners to be split into breakout rooms and assigned teamwork to make decisions and prepare for the virtual plenary presentation. Briefly, the digital effectiveness of the video conference by utilizing breakout rooms in higher education is presented in the following case study.

4. Experiments

Breakout rooms are thought of not as supportive and favorable as imagined previously when a large number of participants attend since several educators consider it as not providing a good level of interaction among the participants of webinars. Thus, reluctance is observed widely among educators. On the other hand, the recent developments of webinar technology have led to various tools specifically designed that aimed at making participants more active. Besides, the breakout room, as a tool, is found to be more superior to what it was thought of.

Breakout rooms represent virtual classrooms like webinar sessions that allow collaboration between a limited number of webinar participants. Therefore, the teacher can develop specific exercises/tasks and divide the webinar sessions into different places where participants can cooperate in some group work and stay away from other groups. The teacher can attend the breakout rooms to supervise the trainees' work or to participate in a specific place when needed by the request of the participants. Breakout rooms can be used to resolve problems, develop arguments on a specific topic, etc. The exercises/tasks assigned to different groups may be different, or the teacher may give a single problem to be tackled and stimulate competitiveness between teams by providing specific incentives for the team who will provide the right solution first.

Then, the results of the work done in the different breakout rooms can be shared with all the other participants in the main webinar session. Therefore, the feature of breakout rooms is the facilitation of the most creative engagement of the participants in the webinar through the interaction with their peers and the promotion of quality teamwork in the virtual environment.

In this particular case study, the instructor uses breakout rooms and other tools available to support the learning process such as private chat, public chat, and private digital board in such a way that learners actively participate and have multiple opportunities to engage with the team. It should be noted that this study was conducted 6 times in an online class of 20 college students who were familiar with the tools of distance learning. Breakout rooms were also devised randomly with a maximum participant of 4 people in each room.

More specifically, the instructor directed the trainees to a question or a problem to explore and ask them to send him/her the answer through private written conversation (the answer was the cooperation of the students of each room). The outcomes of the process result in the following:

(1) All the trainees participate in the activity since they as a group must respond to the trainer

(2) If a group sends the wrong answer through the private written conversation, the instructor asked them to try to solve it again

(3) The trainees are not "exposed" to the whole class, but only to their group

(4) All groups had to submit their answer at a predetermined time as they do not have access to the answers of others

With this approach, the phenomenon of "agree" is eliminated since learners cannot agree with the previous answer. However, it is a common practice in the physical classroom, which is not possible in this setting, since learners hear the answers of others and express their opinions with either agree or disagree. The application of this approach contributes to the enhanced involvement of the trainees and the satisfaction of the latter for active participation in the online course through small groups.

Afterward, the instructor brought the students back to the plenary session to further negotiate a specific issue, utilizing the learners' answers and developing a collaborative framework that further encouraged online collaborative learning after completion of the first task.

In the second task, the trainer asks for the answers of the new groups that were separated in breakout rooms through the written conversation of the group but asks them not to send their answer until he tells them to send it. In this way, all groups participate and must complete the activity independently without being able to see the response of others. In this case, there is a risk of exposure of learners in the group so something needs to be pedagogically managed by the instructor in the classroom, while, on the other hand, each group is allowed to directly compare the answers with the answers of the other groups.

The third task involved the utilization of digital boards in multiple groups (one for each new room). More specifically, each group works on its board, compiling its response and receiving differentiated support from the trainer according to their needs. In this way, the participation of all trainees is achieved without exposure in the classroom.

The above approaches to the operation of the simultaneous online classroom contribute to both the active involvement of all learners and the increase of their participation in small groups. Thus, the possibility of activating synapses and neural circuits is expected based on the result of the opportunities to gain experience and build knowledge increment to a high degree in contrast to a passive process where the learner can hear and/or see with or without multimedia applications such as a simple presentation or lecture.

In the context of constructing, consolidating, storing, and retrieving the new knowledge, the instructor with the offered digital means carried out diagnostic, formative, and final evaluation for each student. Specifically, the instructor using the voting with right/wrong type questions, multiple-choice questions, and matching sentences evaluated the students while allowing them to strengthen their memory to reflect on what they know and what they have understood as well as to identify their personal needs. The evaluation was done in the form of voting where only the instructor sees the students' answers so that there is an attractive framework for participation.

It should be noted that the questions were structured in such a way that consisted of more than one correct answer. Hence, this technique increases the curiosity of the trainees and enhances their participation. The completion of such a process and the answers given by the trainees make the instructor construct new working groups and redefine his teaching practice to meet the needs of the trainees based on more evaluative criteria. In addition, while the development of the brain is further enhanced by making good use of the teaching obstacles, grading has been shown to enhance their interest since the mistakes presented by the instructor resulted in a high degree of grading success. This process was achieved during online learning in which learners needed to be even more actively involved in the learning process to improve or maintain their grades.

Also, the opportunity was given through interactive discussion of the educational subjects to identify failures or mistakes within the group. Hence, the opportunity is given to trainees to review both individual and collaborative mistakes to overcome specific didactic obstacles that lead to misunderstandings. This assessment was made by personal teleconference with the instructor in the form of a press conference for each trainee.

Finally, the trainees were allowed to illustrate how they worked through the presentation. Besides, how each group focuses on their works to identify and correct mistakes by highlighting their strategies was presented. We believe that the strategies identified can be supportive for other learners that allow them to acquire and develop different skills by observing other groups and modeling their behaviors and actions in future respective assessments.

5. Discussion

In this paper, the value and the ways of effective utilization of video conferencing in an online learning environment were presented with a case study following the principles of educational neuroscience and distance education, so that they can function as educational and learning aids appropriate to further examine the objectives of higher education based on the use of available digital technologies. Given the theory of televised proximity that "places" the group of learners in a teleconferencing environment, a successful educational experience with teleconferencing has been shown, which leads to the maximum possible learning outcomes based on the proper coexistence of teleconferencing, televised-teaching, and televised-social presence.

It was also suggested experimentally that the televised-cognitive presence in the televised-learning contains all those elements and actions that activate the cognitive function of the learners. Hence, the proper planning of the educational process and the way of presenting the content are necessary, which is a key conclusion emerging from the case study in this manuscript.

Furthermore, the principles of neuroscience and the theories of audiovisual learning applied to lifelong learning have practically suggested that adaptation to the environment of distance education has many better consequences for learners. The outcomes of the case study highlight the importance of the effect of audiovisual learning on specific pedagogical parameters, such as interactive distance, autonomy, structure, dialogue, communication, but also on emotional expression, learning climate, and knowledge acquisition in a collaborative environment.

In conclusion, proper planning of the educational process can lead to reducing distance issues and enhancing the learning process through appropriate actions related to autonomy, structure, and dialogue. At the same time, the way the content is presented in the video conference brings the transmission of audiovisual messages, participation, and interaction, once the benefits of the software are fully utilized. The educational process can be a springboard for a more effective and efficient learning system. Correspondingly, the audiovisual messages (verbal or nonverbal) through their corresponding presentation activate the appropriate areas of the participants' brains. Therefore, the application of the principles of neuroscience, information processing theory, and the theory of shape can help determine how information is stored in long-term memory achieving more efficient learning. Finally, the audiovisual messages shaping the visual perception, in turn, affect the dialogue and lead to the creation and expression of emotions that might be common to all participants in the teleconference. Hence, the logical thinking of the learners is influenced by the transmission of emotions and imitation of the teacher's thoughts.

The empirical techniques proposed on this basis construct the relationship between the learning process in video conferencing and visual perception. Moreover, the educational process will highlight the value of the audiovisual implementation.

6. Conclusions

What the current research implies is that the proper planning of the educational process and the means used for presenting the content should be devised properly, which is one of the results of the case study in this manuscript. Moreover, the principles of neuroscience and the theories related to audiovisual learning contribute practically to the adaptation of the environment of distance education and result in many better consequences for learners such as interactive distance, autonomy, structure, dialogue, communication, emotional expression, learning climate, and knowledge acquisition in a collaborative environment.

This research needs to investigate further the relationship between the theories of audiovisual learning and the teleconferencing methods since the findings suggest that the achievement of learning outcomes in distance education programs utilizing video conferencing is observed. It is also particularly interesting to study whether distance learning instructors who use video conferencing rely on theories such as cognitive load theory and multimedia learning theory to design both the teaching material and the educational process.

Data Availability

The data used to support and prove the findings of this study are available from corresponding author upon request.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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