CRITERIA FOR DESIGNING AND EVALUATING THE QUALITY OF VIRTUAL CLASSROOMS DURING EMERGENCY LEARNING

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ABSTRACT

Distance education during emergencies requires planning, design, and goal setting to create an effective learning environment. Virtual distance education involves more than just uploading educational content; it is rather an educational process that provides choice for learners, as well as flexibility and responsibility for learning and academic support. In this context, the aim of this research is to determine the quality criteria for designing virtual classrooms with their different styles (synchronous, asynchronous, and blended), and organizing them into categories and criteria to verify the availability of the criteria required for learning in the virtual environment. Also, the research aims to propose a method for evaluating and measuring the extent to which virtual classrooms during emergency learning meet its design quality criteria. The study used the descriptive method and analysis processes to determine the quality aspects of the virtual classrooms design, to draw out the design criteria and quality indicators, and to explore the opinions of the research population on the importance of these criteria and their measurement indicators. A purposive population of (17) specialists in the field of educational design and e-learning participated in the study, all of whom hold a PhD degree in the specialty in order to systematize the list of criteria for designing the virtual classroom and the indicators for measuring them in light of emergency learning. The importance of this current research lies in its aim to contribute to the improvement of training and learning environments through virtual classrooms during emergency learning, and to provide a list of design criteria that benefit teachers and instructional designers, in addition to reconsidering the use of learning management system tools and electronic content with virtual classrooms in order to achieve the maximum benefit for students in achievement outcomes of their learning, especially in the context of emergency learning.

Keywords: Emergency distance learning, emergency remote teaching, COVID-19, online learning, distance education, digital learning.

INTRODUCTION

Online education in its various styles is increasingly and steadily growing all over the world, not because of emergencies alone but also because of the impact of new digital technologies, and the increasing demand for manpower that possesses digital skills to deal with the ever-evolving digital economy.

Covid-19 pandemic has posed a big challenge to education throughout the world. Many governments have decided to suspend face-to-face education and replace it with distance education in emergencies in a response to stop the spread of coronavirus. According to a UNESCO report (UNESCO, 2020), more than 1.5 billion learners or nearly 90% of the enrolled students worldwide have been affected by the schools and educational institutions lockdown; for that, measures to face the lockdown have been taken on a global scale, and lessons have turned to be delivered via various channels such as e-learning management systems, broadcasts, television, web portals, etc. The speed of this educational transformation has been phenomenal. Within a short period of time, teachers with years of experience in face-to-face teaching had to shift to online classes, moving educational content via virtual classrooms as a step forward to help prevent the spread of coronavirus.

Instructors had to discover how to shift their practices from face-to-face to distance teaching in emergencies, and that includes creating spaces for online content, new tools to deliver the content, understanding the online pedagogy, engaging parents, and using different pedagogical strategies to address teaching and learning both synchronous and asynchronous (Hartshorne, Baumgartner, Kaplan-Rakowski, et.al., 2020). The lockdown caused by the world pandemic has necessitated that nearly all teachers should use technology to reach out and teach learners remotely, while virtual learning has been hastily applied, driven by the immediate need to adapt to rapid changes in delivery.

The process of emergency distance teaching requires careful planning, design, and goal setting to create an effective learning environment (Themelis & Sime, 2020). Distance virtual learning involves more than just uploading educational content; it is rather an educational process that provides learners with choice, flexibility, responsibility for learning, and academic support. Well-planned virtual learning experiences are different from the delivery of educational content delivered online in response to a crisis or disaster. Educational institutions that provide education during emergencies must understand these differences when providing distance education in emergencies. In this context, this research aims to achieve the following objectives:

- Determining the criteria of design quality of virtual classrooms with their different styles (synchronous, asynchronous, and blended), and organizing them into categories and criteria to verify the availability of the criteria required for learning in the virtual environment.
- Proposing a method for evaluating and measuring the extent to which virtual classrooms, during emergency learning, meet the criteria of their design quality.

The importance of this current research lies in its aim to contribute to the improvement of training and learning environments via virtual classrooms during emergency learning, and to provide a list of design criteria that benefit teachers and instructional designers, in addition to reconsidering the use of learning management system tools and electronic content with virtual classrooms in order to achieve the maximum benefit for students in achievement outcomes of their learning, especially in the context of emergency learning.

THEORETICAL FRAMEWORK

This section describes the e-learning and distance education in emergencies, virtual learning environments, and their design criteria.

E-Learning and Distance Education in Emergency Situations

Access to education is directly disrupted by emergencies such as wars, conflicts, natural disasters, or disease outbreaks (Creed & Morpeth, 2014). UNICEF has reported that about 35 million children are missing out on education due to conflicts or disasters (UNICEF, 2018). The recent outbreak of COVID-19 worldwide has added another example to the emergency learning environment.

The current unprecedented challenge and the ongoing emergency caused by COVID-19 has led to a greater use of e-learning and virtual learning environments than ever before as an emergency response to enable the continuity of education and to make teaching and learning possible and resilient. Educational institutions around the world have chosen to use distance education through various LMSs and other web-based platforms to create virtual classrooms instead of traditional classrooms.

Distance education in emergencies is defined as a temporary shift in education delivery to an alternative delivery method during a crisis. It involves the use of entirely remote teaching solutions and processes for teaching which has been being provided primarily on a face to face-to-face basis, and that it will revert to the traditional method once the crisis has passed (Hodges, Moore, Lockee, et.al., 2020). The primary focus of distance education in emergencies is not to build a completely new education ecosystem but to provide temporary and alternative access to education under the crisis conditions (Tung Son, Ngoc Anh, Quoc Tuan, et. al., 2020).

Virtual learning environments provide tools for emergency teaching and guide teachers towards delivering learning content within the full context of a student's curriculum, organizing communication within the classroom, providing rich learning options for students, and providing tools for delivering learning resources and materials to students (Anthony Jnr, & Noel, 2021; Bruns, et.al. , 2021). Many educational institutions have adopted virtual learning platforms such as Blackboard Learn, Blackboard Collaborate, Moodle, Google Classroom, Skype, Microsoft Class Note, Microsoft Teams, etc., to replace face-to-face classes with virtual online classes (Crawford, 2020).

Online teaching and learning have been studied for decades. Many research studies, theories, models, and standards have focused on the quality of teaching, online learning, and the design of online educational content. The results of several studies (Cidral, et. al., 2018; Mtebe & Raphael, 2018; Al-Samarraie, et. al., 2017; Chen, & Yao, 2016) prove that effective online learning results from careful instructional planning and design, through the use of a systematic model for design and development. The design process and careful consideration of various design decisions affect the quality of education. On the other hand, this rigorous design process will be absent in most hasty situations of emergency learning unlike experiences that are planned beforehand and are in place from the start and designed to be online because the primary goal in emergency settings is not to create a strong learning environment, but to provide temporary access to education and educational support in a quick and reliably available setting during emergencies or crises (Arora & Srinivasan, 2020).

There are many theories and guidelines for the application of distance learning in recent years. However, implementing it in a short time is not easy, as many factors are impossible to carry out such as curricula review, materials preparation, training of lecturers and students, and preparation of relevant infrastructure (Tung Son, et. al., 2020). However, defining the criteria for designing virtual classrooms is essential to provide quality distance education as an effective means of dealing with emergencies.

Environments of Virtual Classrooms Learning

The virtual learning environment is defined as an integrated electronic learning environment, used in the creation and management of educational content, learner management, learning processes, events, activities, interactions, and evaluation processes; it enables teachers and learners to communicate, interact, and share, whether in a synchronous or asynchronous manner, and to provide assistance and guidance as well as educational and technical support online, and therefore the virtual learning environment is the backbone of e-learning (Khamis, 2018).

The virtual classrooms of all styles (synchronous, asynchronous, and blended virtual classroom) represent one of the most important applications of educational technology; these classes are classified as one of the main means in interactive e-learning systems. They include tools that increase the diversity of the teacher's role and effectiveness, and also increases the role of the learners in the learning environment, strengthens their cooperation with peers participating in the virtual classroom, and enables both teachers and learners to interact as if they were face-to-face in traditional classrooms, but with more effective procedures and processes, commensurate with the virtual learning environment (Mercimek, & Caka, 2022; Martin & Parker, 2014).

Virtual classrooms offer the best means of simulating the positive qualities of face-to-face education thanks to their synchronous and asynchronous nature (Derboven, Geerts, & De Grooff, 2017). Virtual classrooms benefit learners in acquiring diverse knowledge and skills, develop learners' motivation for higher achievement, and help them participate in teamwork and cooperation in a way that promotes joint knowledge-building, as well as developing skills related to interaction that results in more meaningful learning processes (Herrera-Pavo, 2021). The use of virtual learning platforms has provided its ability to overcome the challenges facing educational and training institutions in providing quality learning; also, virtual training has provided the same advantages as the traditional training, as it gives the trainee the opportunity to gain practical experience in a virtual environment, as well as providing opportunities to use a flexible mix of teaching and training methods (Ruggiero, & Boehm, 2016; Moazami, et. al., 2014).

The use of virtual learning environments in education is no longer in question. Its effectiveness has been proven in many educational situations at different levels of study. Previous studies have revealed the effectiveness of training through virtual classrooms with different learning outcomes. The results of the study of Zwart, Goei, Noroozi, et. al., (2021) demonstrated that virtual learning environments have provided useful educational tools for training nursing students to carry out professional duties and tasks and facilitating additional support for learning Sports Medicine. The study of Balasubramaniam, Bhargava, Agrawal, et. al., (2018) confirmed the results of the previous study about the effectiveness of a virtual training model in improving key nursing skills for a group of nursing assistants. The study of Crane, (2017) also demonstrated that synchronous and asynchronous employee training through virtual classrooms succeeded in acquiring practical practices in the hospital environment. In addition, a study by Yilmaz, (2015) showed the positive effects of synchronous virtual classes on students' achievement in distance learning of physics at Istanbul University.

During emergency learning, training and learning via virtual classrooms bring about good learning experiences and acquisition of new skills (Agrati, & Vinci, 2020), improve student learning of pharmaceutical sciences (Alqurshi, 2020), and teach remote medical sciences quickly through providing engagement and high-quality learning experiences for learners of Western Michigan University School of Medicine (Vollbrecht, et.al., 2020). The virtual classrooms have also contributed to the distance training for teachers during emergencies and have achieved positive results in acquiring the necessary skills to provide effective education during the pandemic period (Islam, Nur, & Talukder, 2021; Llerena-Izquierdo, & Ayala-Carabajo, 2021; Whalen, 2021).

A review of the previous literature (Nortvig, Petersen, & Balle, 2018; Wang, Quek, & Hu, 2017; Berry, 2017; Stohr, et.al., 2016; Jordan, 2016; Politis, & Politis, 2016) reveals styles of cross-curricular instruction through classrooms and their analysis, and this has resulted in a number of conclusions. The first of which is that the synchronous style of virtual classes facilitates social interaction, which is an important factor to motivate the learners to participate in all learning activities; the second important advantage is the provision of instant instructing, where the instructor is present throughout the webinar or training sessions, and can have a real-time dialogue with the participants, and this also increases levels of motivation and interest and helps reduce the sense of distance and isolation that occurs during the asynchronous e-learning. In contrast, asynchronous virtual classes lack the real-time aspect, but give participants more time to think before contributing, while the blended style of virtual classes combines the advantages of both synchronous and asynchronous styles. Also, there are clear differences between the methods and tools of each style and these differences must be taken into consideration when designing pedagogical strategies.

Also, a review of previous studies (Nortvig, Petersen, & Balle, 2018; Wang, Quek, & Hu, 2017; Berry, 2017; Stohr, et.al., 2016; Jordan, 2016; Politis, & Politis, 2016) demonstrated that there is a discrepancy in preferring one type of education over another in training through virtual classrooms on learning outcomes. Therefore, careful analysis of the different styles of online classes points to the fact that no single medium can deliver the perfect teaching and learning experience on its own, each focusing on one or several aspects of the process. Thus, the most important thing to consider when adopting e-learning tools is the best way to combine different synchronous and asynchronous styles in order to provide an appropriate learning structure for different learners, contexts, and content. Moreover, with consideration of the complexity of the educational process, the use of these tools is not an end in itself, but rather a means to provide a high-yielding teaching and learning experience; and that the way they are used requires a great focus on

the basic educational aspects and the role of the teacher, in addition to focusing on the quality of the educational design of those virtual environments, which is what the current research seeks to study by setting the necessary criteria for designing virtual classrooms.

Criteria for Designing Virtual Learning Environments

The design of virtual learning environments requires defining the principles, criteria, precise indicators, and developing an appropriate model for designing and evaluating these environments. Previous literature revealed that there are many criteria for designing and evaluating these environments, which are difficult to list in this context, but the researcher has reviewed some of them. For instance, Cidral, et. al., (2028) have focused the criteria for system quality, the quality of its use, the quality of information, the criteria for diversity in evaluation methods, and the quality of cooperation and partnership with others (Cidral, et. al., 2018). On their part, Mtebe & Raphael, (2018) developed a model in which they focused on system quality criteria, course instructor quality, service quality, and course quality. In the model of Chen, & Yao, (2016), they set the criteria for the virtual learning environment, which were the quality of the course instructor, the quality of the course content, the quality of the technology used, and the quality of the design. Also, Al-Samarraie, et. al., (2017) identified five criteria for achieving the quality of the e-learning environment as follows: the quality of information, the quality of the system, the ease of the technology used, the utility, and the benefit.

In light of the literature review and previous studies, and in light of the theoretical foundations of learning in virtual environments, and the experience of researchers in using virtual classroom systems for a long period, this research identifies a number of criteria, and formulates a number of foundations and indicators that must be taken into consideration when designing virtual learning environments in the context of emergency learning, as provided in the section of research procedures and results.

RESEARCH QUESTIONS

The research problem was identified in the following main question: *"How can a virtual learning environment be designed during emergency learning?"*.

To answer this main question, the following sub-questions were formulated:

Q1: What are the quality criteria for designing virtual classrooms during emergency learning?

Q2: What is the method of applying the quality criteria for designing the virtual classrooms during emergency learning?

METHOD AND PROCEDURES

Methodology

Since the current research is a developmental research in educational technology, the descriptive approach was used in the study and analysis processes to determine the quality aspects of the design of virtual classrooms, and to draw out the design criteria and quality indicators, and to explore the opinions of the research population about the importance of these criteria and their performance indicator.

Population

The research population consisted of faculty members and instructional designers from experts specialized in the field of educational technology and e-learning. A purposive sample of (17) specialists working in Saudi universities and e-learning centers participated in the research, all of whom have a PhD degree in the specialization, (5 professors, 4 associate professors, 8 assistant professors); This is for the purpose of systemizing the list of criteria for designing the virtual classrooms and the indicators for measuring them in light of emergency learning.

Procedures

The design and development of learning environments in the virtual classrooms requires defining a set of criteria in light of which design processes and procedures are carried out. The researchers have identified a list of these criteria according to the following steps:

A. Determining The Sources of The Criteria: In setting the criteria, the researchers relied on the literature review and previous scientific studies (Khamis, 2018; Cidral, et. al., 2018; Mtebe & Raphael, 2018; Al-Samarraie, et. al., 2017), and on exploring the opinions of specialized experts and consultants in the field of educational technology, e-learning, and instructional design on the lists of criteria proposed by the researchers. Conditions and specifications were defined to build criteria for designing and evaluating the quality of the virtual classrooms, which resulted a preliminary list of criteria consisting of (10) basic criteria, and (103) measurement indicators.

B. Organizing The List of Criteria: The Criteria Contained in The List are Organized as Follows:

- A general criterion that expresses an aspect of the instructional design and the use of the virtual classroom.
- Sub-criteria representing the general criterion; it includes a set of performance indicators.
- Criteria or performance indicators which are used to measure the extent to which the design criterion for the virtual classroom is achieved.

C. Arbitration of Criteria and Determining Their Relative Importance:

- A preliminary list of criteria consisting of (10) basic criteria, and (103) measurement performance indicators were presented to the research group, (17) arbitrators, to express their opinions and suggestions about these criteria, their importance, and their relevance to the general area of design quality for the virtual classroom, the clarity of their performance indicators associated with them, as well as the reliability of these criteria, and their suitability for the purpose of the current research.
- The arbitrators were asked to determine the relative importance of each of the criteria for designing the learning environment in the virtual classroom on a five-step scale.
- The relative importance of each criterion for designing the virtual classroom environment was calculated according to the opinions of the arbitrators, and then the average relative weight was calculated, and the criteria that obtained 80% or more of the approval of the total number of arbitrators were maintained.

D. Final List of Criteria: After reviewing and obtaining the opinions of the research arbitrators, the researchers carried out the following in light of their remarks:

- With regard to the criteria, the arbitrators agreed on them with some remarks, based on which the researchers combined the educational technology criteria with the technology used, and combined the criteria of quick and easy navigation, with the criteria of technical foundations for the design of the virtual learning environment. The final list of criteria of quality evaluation of the virtual classroom consisting of (8) basic criteria, are: 1) technology used in the virtual classroom, 2) educational content design in the virtual classroom, 3) learning content management in the virtual classroom, 4) learning environment in the virtual classroom, 5) teaching and learning strategies in the virtual classroom, 6) technical foundations for virtual classroom design techniques, 7) evaluation/assessment and feedback in the virtual classroom, 8) the perceived cost and benefit of a virtual classroom environment.
- Regarding the indicators, the arbitrators agreed on their validity, with some remarks, based on which the researchers modified the linguistic formulation of some indicators, and included some other indicators under the criteria that pertain to them, and omitted (13) indicators to avoid repetition.

The necessary amendments were made in light of the arbitrators' remarks and comments, so that the list of criteria for designing the virtual learning environment online in its final form consists of (8) criteria and (90) indicators for measurement.

RESEARCH RESULTS

The First Question: "What are The Criteria for Designing The Virtual Classroom During Emergency Learning?"

To answer this question, the mean of the responses has been calculated for the degree of significance of each criterion of the virtual class design, and the degree of significance of each indicator to measure the criterion has been calculated; this was based on the following degrees of importance: (Very important = 5, Highly important = 4, Important = 3, Moderately important = 2, Slightly important = 1, Not important = 0), after having presented the list of the proposed criteria to the research population, the results were as shown in the following tables (1-8):

(1) Technology Used in The Virtual Classroom

Table 1. Mean response scores for importance of the criterion of technology used and its measurement indicators

Criterion (1)	Indicators	Mean
The instructional design of the learning environment in the virtual classroom employs technological criteria to design an appropriate application interface that facilitates learning and its occurrence.	1.1 The virtual classroom environment provides a simple, uncomplicated, and easy to use interface.	4.38
	1.2 The Virtual Classroom platform is easy to use.	4.25
	1.3 The use of the system conforms to international specifications and standards in the design of content and operation.	4.18
	1.4 The virtual separation system has the ability to operate and use via mobile devices.	4.11
	1.5 The virtual classroom system informs students of the requirements to run it on their computer.	4.17
	1.6 The virtual classroom environment supports all types of multimedia files supported by the Internet browser, such as interactive Java files, and 360 virtual reality files.	4.03

The results contained in Table 1 above reveal the high averages of the degree of importance of the criterion of technology used and the importance of indicators for measuring this criterion, where the values of the arithmetic averages ranged from 4.03 to 4.38 on a scale of 5 points, which are high values at the score of Very high importance range, which reflects the importance of these criteria and their indicators in measuring the quality of the virtual classroom design.

(2) Educational Content Design in The Virtual Classroom

Table 2. Mean response scores for importance of the criterion of technology used and its measurement indicators

Criterion (2)	Indicators		Mean
The instructional design of a virtual classroom learning environment provides instructional content that is comprehensive enough to achieve the objectives set for the instructional content and learning outcomes, and is prepared by qualified professionals	2.1	The learning content of the virtual classroom is appropriate to help the learner achieve the learning objectives.	4.34
	2.2	The content respects accuracy, objectivity and modernity, and the content is comprehensive, appropriate, consistent, and diversified.	4.21
	2.3	The content in the virtual classroom is clear, understandable, and free of spelling or grammatical errors.	4.17
	2.4	The presentation of the content in the virtual classroom is organized in a sequential manner that facilitates students' assimilation and stimulates their motivation towards learning.	4.24
	2.5	The scientific material is divided and presented into successive parts.	4.22
	2.6	The educational content is available in the virtual classroom in the form of multimedia such as video files, audio files, and instructional images.	4.15
	2.7	The virtual classroom includes learning activities following each task, and the activities cover all aspects of the content.	4.21
	2.8	The learning activities in the virtual classroom range from easy to difficult, and from concrete to abstract.	4.14
	2.9	The virtual classroom takes into consideration linking educational activities with life situations, and provides integrated educational experiences.	4.20
	2.10	It allows content creation and configuration within the virtual classroom environment.	4.18
	2.11	It allows the learners to update learning content without the need for a new version.	4.01
	2.12	The virtual class system allows content retrieval and configuration.	4.13
	2.13	It allows content to be downloaded, exchanged, and shared with others.	4.09
	2.14	It allows downloading of multiple files in different standard formats.	4.14

The results contained in Table 2 above reveal the high averages of the degree of importance of the criterion of technology used and the importance of indicators for measuring this criterion, where the values of the arithmetic averages ranged from 4.01 to 4.34 on a scale of 5 points, which are high values at the score of Very high importance range, which reflects the importance of these criteria and their indicators in measuring the quality of the virtual classroom design.

(3) Learning Content Management in The Virtual Classroom

Table 3. Mean response scores for importance of the criterion of technology used and its measurement indicators

Criterion (3)	Indicators		Mean
The instructional design of the learning environment in the virtual classroom makes it easier for learners to deal with the learning content and manage it in multiple ways.	3.1	It is easy for learners to access learning content easily.	4.21
	3.2	It is easy for learners in the virtual classroom to track their progress in studying the content.	4.26
	3.3	It is easy for learners in the virtual classroom to know the learning tasks, activities, and update its content.	4.18
	3.4	The virtual classroom environment enables searching within the content.	4.29
	3.5	The virtual classroom provides tools for presenting educational activities that enable students to generate ideas and achieve higher levels of understanding.	4.13
	3.6	The virtual classroom environment provides students with tools to help them design educational activities that achieve the desired learning objectives.	4.9
	3.7	The virtual classroom environment presents the content in a way that stimulates students' thinking.	4.11
	3.8	The virtual classroom environment provides a variety of opportunities for students to interact with the content, with the teacher, and with each other.	4.06
	3.9	The virtual classroom environment considers presenting the content in a way that helps students discuss multiple points of view on the topic and draw conclusions.	4.12
	3.10	The virtual classroom environment provides the presentation of appropriate, varied and comprehensive questions and exercises.	4.18
	3.11	The virtual classroom environment provides adequate opportunities to solve learning activities in synchronous and asynchronous styles.	3.95
	3.12	The virtual classroom environment provides specific dates and methods for easy delivery of learning activities and tasks.	4.09

The results contained in Table 3 above reveal the high averages of the degree of importance of the criterion of technology used and the importance of indicators for measuring this criterion, where the values of the arithmetic averages ranged from 3.95 to 4.29 on a scale of 5 points, which are high values at the score of Very high importance range, which reflects the importance of these criteria and their indicators in measuring the quality of the virtual classroom design.

(4) The Area of Learning Environment Management in The Virtual Classroom

Table 4. Mean response scores for importance of the criterion of technology used and its measurement indicators

Criterion (4)	Indicators		Mean
The instructional design of the learning environment in the virtual classroom makes it easy for learners to manage the learning environment, and to track its status during the learning process.	4.1	The system facilitates the process of registering the student to attend the virtual class sessions, or to leave them whenever he wants.	4.36
	4.2	The virtual classroom environment regulates communication between students and faculty members, and between students, and students and content.	4.41
	4.3	The virtual classroom environment allows students to upload files and images in different standard formats, and suitable storage spaces.	4.23
	4.4	The virtual classroom environment provides aids such as the Whiteboard for students to present their ideas and plans for solving problems.	4.09
	4.5	The virtual classroom environment allows students to freely and easily navigate and control the content structure.	4.14
	4.6	Each student's virtual classroom involves creating their own E-profile.	4.21
	4.7	The virtual classroom environment assesses student performance in a synchronous and asynchronous manner.	4.19
	4.8	The virtual classroom environment regularly displays feedback on student performance.	4.24
	4.9	The virtual classroom environment displays students' feedback and opinions on developing learning content and learning style.	4.15
	4.10	The virtual classroom environment provides monitoring of formative and summative assessment results.	4.21
	4.11	The virtual classroom system enables keeping track of the student's status during the learning process.	4.25
	4.12	The virtual classroom system provides guiding information that shows how to learn through the different virtual classroom styles and tools.	4.17
	4.13	The virtual class system provides scheduling synchronous and asynchronous sessions, and provides reminders and notification of their appointments.	4.07
	4.14	The virtual classroom system provides learners with easy creation and management of work and group learning groups, and assigns roles for learners in each group.	4.31
	4.15	The virtual classroom environment allows all the synchronous virtual lectures to be recorded in the system so that students can retrieve them at any time.	4.28
	4.16	The virtual classroom environment enables students to conduct text, audio, video, and gesture conversation.	4.17
	4.17	The virtual classroom environment enables students to watch educational videos, and hear audio files related to the content.	4.22
	4.18	The virtual classroom environment enables students to view their projects and learning tasks within the learning management system.	4.24
	4.19	The classroom system facilitates the generation of reports on the performance of both the teacher and the learner, and allows saving and printing them.	4.20
	4.20	The virtual classroom environment provides a clear guide on how to use it and use its tools.	4.18

The results contained in Table 4 above reveal the high averages of the degree of importance of the criterion of technology used and the importance of indicators for measuring this criterion, where the values of the arithmetic averages ranged from 4.07 to 4.41 on a scale of 5 points, which are high values at the score of Very high importance range, which reflects the importance of these criteria and their indicators in measuring the quality of the virtual classroom design.

(5) Teaching and Learning Strategies in the Virtual Classroom

Table 5. Mean response scores for importance of the criterion of technology used and its measurement indicators

Criterion (5)	Indicators		Mean
virtual classroom uses teaching and learning strategies and educational activities appropriate to the objectives of the content, its requirements, and the characteristics of learners that allow for a real and meaningful interaction (between the learner and the course instructor, between learners, and between the learner and the content), to motivate learners, enhance academic commitment, and keep the learner actively engaged in the learning process.	5.1	The instructional design of the virtual classroom uses learning activities appropriate to the objectives and requirements of the content.	4.38
	5.2	The instructional design of the virtual classroom uses learning activities that are appropriate to the characteristics of the learners and motivate and keep them engaged in the learning process.	4.28
	5.3	The learning activities, discussions, and collaborative assignments in the virtual classroom are well designed to facilitate collaborative and individual learning among students.	4.19
	5.4	The design of the virtual classroom learning environment uses clear and appropriate methods, mechanisms, and instructions to achieve diverse interactions and learning activities.	4.22
	5.5	The design of the virtual classroom learning environment allows for ongoing support and assistance for the learner as they go through the learning process.	4.30
	5.6	The virtual classroom system makes it easier for learners to use discussion forums, educational blogs, and other asynchronous communication tools.	4.08
	5.7	The virtual classroom system makes it easier for learners to take notes while interacting with the learning content in a way that ensures the learner's self-organization.	3.92
	5.8	The virtual classroom system makes it easy for learners to communicate with each other in a synchronous manner.	4.21
	5.9	The virtual classroom environment enables the use of different styles of interaction between the learner and the content.	4.13
	5.10	The virtual classroom environment allows the student to control the choice of type, level, and quantity of examples, applications, and exercises.	4.17
	5.11	The virtual classroom environment stimulates the student's active engagement in the learning events.	4.23
	5.12	The virtual classroom environment considers supporting the learner-centered learning.	3.95
	5.13	It is considered that the duration of the virtual classroom session should not exceed (60-90) minutes per session, to ensure participation and interaction, as well as group cohesion.	4.31

The results contained in Table 5 above reveal the high averages of the degree of importance of the criterion of technology used and the importance of indicators for measuring this criterion, where the values of the arithmetic averages ranged from 3.92 to 4.38 on a scale of 5 points, which are high values at the score of Very high importance range, which reflects the importance of these criteria and their indicators in measuring the quality of the virtual classroom design.

(6) Technical Foundations of Virtual Classroom Design Techniques

Table 6. Mean response scores for importance of the criterion of technology used and its measurement indicators

Criterion (6)	Indicators		Mean
The instructional design of a virtual classroom learning environment uses technical principles to design multimedia elements to capture the learner's attention.	6.1	The instructional design of the virtual classroom includes the use of quality and clear written instructional texts.	4.45
	6.2	Texts are written in easy, simple, and understandable words.	4.37
	6.3	The words have a specific meaning and not interpreted in any other sense.	4.31
	6.4	It is insured when writing the content that no more than three font sizes are used on one screen.	4.26
	6.5	The texts are free of spelling and grammatical errors.	4.39
	6.6	Images, static and line drawings are used functionally as needed to achieve the learning objectives.	4.26
	6.7	Instructional phonics are of quality and clarity.	4.22
	6.8	The live tempo of the teacher's voice during his explanation is maintained via the synchronous virtual class.	4.16
	6.9	Instructional images and graphics are of good quality and clarity, and support the educational content.	4.22
	6.10	The instructional videos are of high quality and clarity, and support the educational content.	4.18
	6.11	Animations are used in educational situations for which videos cannot be used	4.09
	6.12	The animation is accompanied by an audio voice-over.	4.06
	6.13	Navigation tools in the virtual classroom facilitate quick and easy access for learners to other sources of knowledge.	4.17
	6.14	Navigation mechanisms are effective and allow the learner to move between parts of the content easily and conveniently.	4.21
	6.15	The links used in navigation are appropriate, clear, and work correctly without errors.	4.23

The results contained in Table 6 above reveal the high averages of the degree of importance of the criterion of technology used and the importance of indicators for measuring this criterion, where the values of the arithmetic averages ranged from 4.06 to 4.45 on a scale of 5 points, which are high values at the score of Very high importance range, which reflects the importance of these criteria and their indicators in measuring the quality of the virtual classroom design.

(7) Evaluation/ Assessment and Feedback in The Virtual Class

Table 7. Mean response scores for importance of the criterion of technology used and its measurement indicators

Criterion (7)	Indicators		Mean
The design of the virtual classroom employs appropriate assessment strategies to measure learning effectiveness, assess student progress against stated learning goals, as well as measuring the effectiveness and quality of the virtual learning environment.	7.1	The virtual classroom learning environment uses assessment and measurement strategies appropriate to the learning objectives, requirements, and characteristics of learners.	4.38
	7.2	It is easy for learners to access test results, assignments, and tasks.	4.42
	7.3	The virtual classroom system automatically keeps and corrects test results.	4.38
	7.4	The design of the learning environment for the virtual classroom provides adequate two-way feedback to enhance learning.	4.19
	7.5	The design of the learning environment for the virtual classroom provides appropriate feedback in light of test results, assignments, and tasks.	4.21

The results contained in Table 7 above reveal the high averages of the degree of importance of the criterion of technology used and the importance of indicators for measuring this criterion, where the values of the arithmetic averages ranged from 4.19 to 4.42 on a scale of 5 points, which are high values at the score of Very high importance range, which reflects the importance of these criteria and their indicators in measuring the quality of the virtual classroom design.

(8) The Perceived Cost and Benefit of A Virtual Classroom Environment

Table 8. Mean response scores for importance of the criterion of technology used and its measurement indicators

Criterion	Indicators		Mean
The cost of designing and managing the virtual classroom is appropriate, and achieves its objective effectively and efficiently.	8.1	The costs of creating a virtual classroom are appropriate for the purpose for which it was designed.	4.39
	8.2	The costs of creating a virtual classroom take into consideration the financial and economic burden on the students.	4.26
	8.3	Digital learning repositories are used to save the cost of producing digital learning resources and multimedia learning objects to support creating learning content for the virtual classroom.	4.32
	8.4	All criteria for evaluating the cost of creating a virtual class every time period are in place.	4.13
	8.5	The cost of creating a virtual class is proportional to the perceived benefit.	4.22

The results contained in Table 8 above reveal the high averages of the degree of importance of the criterion of technology used and the importance of indicators for measuring this criterion, where the values of the arithmetic averages ranged from 4.13 to 4.39 on a scale of 5 points, which are high values at the score of Very high importance range, which reflects the importance of these criteria and their indicators in measuring the quality of the virtual classroom design.

Results of Answering The Second Question: "What Is The Method of Applying The Quality Criteria for Designing The Virtual Classroom During Emergency Learning?"

The process of implementing the instructional design quality criteria for the virtual classroom requires the use of a grade scale that is both accurate and easy to use. The scale was built as follows:

1. Determining a relative weight or relative importance for each criterion that determines its importance when evaluating the design of the virtual classroom, through three levels (weights): basic criterion is scored (3 points) as the decisive important criterion in the effectiveness of the design of the virtual classroom; very important criterion is scored (2 points) as the criterion that has a moderate importance in the effectiveness of the design of the virtual class; important criterion is scored (1 point) as the criterion that has a low importance in the effectiveness of the design of the virtual classroom.
2. Using a specific rating or value for each criterion to help the evaluator estimate the extent to which the criterion meets or achieves its performance indicators. This rating is determined through a five-point graded scale: Excellent = 5 points for the criterion that meets all its performance indicators; Very Good = 4 points for the criterion that meets all of its performance indicators but vary in quality or implementation; Good = 3 points for the criterion that meets 50%-75% of its performance indicators; Acceptable = 2 points for the criterion that meets from 25%-75% of its performance indicators; Poor = 1 point and is for the criterion that meets less than 25% of its performance indicators; Null = zero for the criterion or any of its performance indicators which are not met.
3. Calculating the total score for the criteria list: the total score = the sum of (relative weight x performance levels score, where the list of evaluation criteria for the design of the virtual class included (8) criteria, (90) performance indicators; thus, the full score for the evaluation of instructional design of the virtual class = (8 x 3 x 5) = 120 points as the highest score (full score), while the minimum score for

the assessment of the educational design of the virtual class = (8 x 1 x 1) = 8. Thus, the list of criteria for the design of the virtual class in its final form is valid for assessing the quality of virtual class during emergency learning.

DISCUSSION

This study has resulted in developing a list of instructional design quality criteria for the virtual classroom, consisting of (8) basic criteria and (90) performance indicators for these criteria. The main areas of quality evaluation of the virtual classroom, as mentioned in the research results, are: 1) the area of technology used in the virtual classroom, 2) the area of educational content design in the virtual classroom, 3) the area of learning content management in the virtual classroom, 4) the area of managing the learning environment in the virtual classroom, 5) teaching and learning strategies in the virtual classroom, 6) technical foundations for virtual classroom design techniques, 7) evaluation/ assessment and feedback in the virtual classroom, 8) the perceived cost and benefit of a virtual classroom environment. The full score for the evaluation of instructional design of the virtual class 120 points as the highest score (full score), while the minimum score for the assessment of the educational design of the virtual class 8 points. Thus, the list of criteria for the design of the virtual class in its final form is valid for assessing the quality of virtual class during emergency learning.

These criteria and their performance indicators were consistent with what was dealt with in the literature and previous studies: (Rabiman, et. Al., 2020; Panyajamorn, et. Al., 2018; Greer, & Harris, 2018) found that effective instructional design of virtual classrooms facilitates access, storage and sharing of educational materials online, and increases learners' satisfaction with the learning environment and the quality of learning. Designing effective e-learning content supports student learning and improves their abilities, and user-centered design can help improve student engagement in learning.

Al Mamun et. Al. (2020 found that the good content design standard acts as interactive scaffolding in learning modules that support learners and promote independent learning for students in an online environment. And studies (Rizeq, et. Al., 2022; Aldiab, et. Al., 2019) agreed with the results of the current study that learning content management systems in the virtual classroom should make it easier for learners to access learning content easily and conveniently, help them know learning tasks and activities, and enable them to search within content and track their progress in content study.

This finding was supported by studies (Coulianos, et. Al., 2023; Aldiab, et. Al., 2019) which found that regulating the management of the virtual classroom environment should facilitate the process of enrolling a student to attend or exit virtual classroom sessions whenever he wishes, facilitating communication between students and faculty, and between students and each other, students and content, creating and managing group learning and working groups, and defining roles for learners in each group easily. The virtual classroom environment also allows all virtual lectures to be recorded simultaneously within the system so that students retrieve them at any time, view student projects and learning tasks within the LMS, generate reports on the performance of both the teacher and learner, and allow them to be saved, and printed.

Studies (Wardani, et. Al., 2021; Ouadoud, et. Al, 2016) found that have found that a good instructional design of the virtual classroom should provide learning activities appropriate to the objectives and requirements of the content, appropriate to the characteristics of learners, motivate them and keep them busy with the learning process, provide educational methods and strategies that will provide clear and appropriate instructions to achieve diverse interactions and learning activities, provide continuous support and assistance to the learner as he walks through the learning process, and ensure participation and interaction in working groups and learning.

Skokanova, et. Al., 2022; Karan, et. Al., 2021 found the effective instructional design of the virtual classroom learning environment should functionally employ images, static and linear graphics, audios and videos as needed to achieve learning goals, be characterized by quality and clarity, and provide sailing tools that facilitate quick and easy access for learners to other sources of knowledge. Also, that effective instructional design of the learning environment for the virtual classroom should employ assessment and measurement

strategies appropriate to learning objectives, requirements and characteristics of learners, facilitate learners to access the results of tests, assignments and tasks, and provide sufficient feedback to enhance learning (Skokanova, et. Al., 2022; Karan, et. Al., 2021).

This finding was supported by (Janssen, et. Al., 2020; Telukdarie, & Munsamy, 2019) who found that the costs of creating a virtual classroom must be appropriate to the purpose for which it was designed, achieve its purpose effectively and efficiently, inexpensive and take into account the financial and economic burden of students.

CONCLUSION AND RECOMMENDATIONS

This study presented a list of quality criteria for designing virtual classrooms with their different styles (synchronous, asynchronous, and blended), and organizing them into categories and criteria to verify the availability of the criteria required for learning in the virtual environment, and also suggested a method for evaluating and measuring the extent to which these criteria are met. In formulating criteria for the quality of designing virtual classrooms, the researchers reached some conclusions, as follows:

- The effectiveness of learning in the asynchronous virtual classroom is determined by the optimal engagement of students, and this engagement can be achieved through factors that enhance learning, such as focusing learners' interest and commitment on their learning, and the presence of motivation and desire for them to accomplish the required learning tasks. These are the two factors that direct learners to engage in content and help them learn new skills.
- The instructional design of the asynchronous virtual classroom should include the facilitation of students' engagement in learning, promotes collaborative behavior patterns, and supports independence in managing their own learning; peer learning through a virtual, asynchronous classroom provides learners with an opportunity to interact and learn from each other, with a positive impact on academic achievement and satisfaction with the expected task outcomes.
- Group work or small group work is successful when learners share a common goal, organize and lead teamwork, and use technology and communication tools in the virtual classroom effectively.

Based on the foregoing results, the current research provides a set of *recommendations and educational implications*, to take advantage of them as practical actions that benefit professors and educational designers when designing virtual learning environments. The most eminent of which are:

- There is a need to pay attention to designing virtual learning environments based on educational foundations and criteria aimed at achieving various learning outcomes, and activating the teaching of practical courses, using the virtual classroom system, as this has an effective impact on providing students with better practical and applied skills.
- There should be diversity in designing learning activities and tasks in virtual environments to meet students' learning preferences, besides joint work and collaboration in implementing learning activities and tasks.

Also, the current research looks forward to *future work* in: Conducting more continuous reviews on these criteria to keep pace with educational updates in virtual learning environments; and conducting correlational studies to study the relationship between the achievement of quality aspects in the design of the virtual classroom and its impact on improving students' learning and skills in the virtual environment.

The importance of this current research lies in its aim to contribute to the improvement of training and learning environments through virtual classrooms during emergency learning, in addition to providing a list of virtual classroom design criteria that will benefit professors and instructional designers, in order to achieve the maximum benefit for students in achieving learning outcomes, especially in the context of emergency learning in response to COVID-19 crises both in the present time and in the future.

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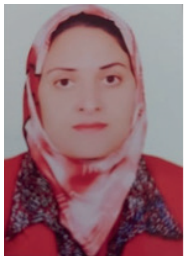

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