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Message from the Editor-in-Chief

Dear Colleagues,

I am very pleased to publish v22i1, 2023 issue. This issue is the success of the reviewers, editorial board, and the researchers. In this respect, I would like to thank all reviewers, researchers, and the editorial board.

This issue covers different research scopes, approaches which subjects about new developments in education educational technology by valuable researchers. The editorial team will be pleased to share various research with this issue as it is the miracle of our journal. All authors can submit their manuscripts to tojet.editor@gmail.com for the next issues.

TOJET, Bahçeşehir University, Sakarya University will organize the International Educational Technology Conference-2023 (www.iet-c.net) on September, 2023 in Istanbul, Turkey.

Call for Papers

TOJET invites article contributions. Submitted articles should be about all aspects of educational technology and may address assessment, attitudes, beliefs, curriculum, equity, research, translating research into practice, learning theory, alternative conceptions, socio-cultural issues, special populations, and integration of subjects. The articles should also discuss the perspectives of students, teachers, school administrators and communities.
The articles should be original, unpublished, and not in consideration for publication elsewhere at the time of submission to TOJET.

January 01, 2023

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A Simulated Situational Assessment System for Evaluating Pre-Service Teachers' Information Teaching Ability

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ABSTRACT
With the deepening of educational reform, classroom teaching constantly emphasizes the importance of context, and the simulated situational teaching method is gradually applied in the instructional design of activities. As an important part of the education and teaching process, evaluation which is the process of determining the changes in students' behavior in teaching through various measurements and systematic data collection should be made changes. At the 2nd International Conference on Technical and Vocational Education, UNESCO proposed that the quality requirements of people in the new era are changing, and learners should not only improve their knowledge and skills but also can adapt and develop. Therefore, it is crucial to assess whether students can achieve problem-solving in real-world situations. Further, the reform of evaluation can provide a clearer direction for teachers' classroom teaching and guide students to change their previous rote learning methods to train higher-order thinking skills. According to the situational cognition and learning theory, the element attributes and preparation steps of situational items, combined with the course content, this study creatively designed and compiled a set of simulated situational items for the "Modern Educational Technology" course for mathematics normal students, and applied Qt which uses a cross-platform C++ application development framework, and MySQL to develop an electronic assessment system. This system can examine learners' ability in terms of using technology to support teaching in information-based teaching, including providing digital teaching resources, information-based instructional design, and teaching practice ability. Meanwhile, it will automatically collect students' answer data and upload them to the database system. It is convenient for teachers to make teaching decisions based on data to improve teaching. This research further promotes the simulation situation evaluation method, which has great application value, and more in-depth research and exploration are urgently needed in the future in this field.
Keywords: situated learning; assessment system; information teaching ability

ÖZET
Eğitim reformunun derinleşmesiyle birlikte, sınıf öğretimi sürekli olarak bağlamın önemini vurgulamakta ve etkinliklerin öğretim tasarımında simüle edilmiş durumsal öğretim yöntemi kademeli olarak uygulanmaktadır. Eğitim ve öğretim sürecinin önemli bir parçası olarak, öğretimde öğrenci davranışlarındaki değişikliklerin çeşitli ölçümler ve sistematik veri toplama yoluyla belirlenmesi süreci olan değerlendirmede değişiklikler yapılmalıdır. 2. Uluslararası Teknik ve Mesleki Eğitim Konferansı'nda UNESCO, yeni çağda insanların kalite gereksinimlerinin değiştiğini ve öğrencilerin sadece bilgi ve becerilerini geliştirmekle kalmayıp aynı zamanda uyum sağlayıp gelişebilmeleri gerektiğini öne sürmüştür. Bu nedenle, öğrencilerin gerçek dünya koşullarında problem çözmeyi başarıp başaramadıklarını değerlendirmek çok önemlidir. Ayrıca, değerlendirme reformu öğretmenlerin sınıf içi öğretimi için daha net bir yön sağlayabilir ve öğrencileri üst düzey düşünme becerilerini geliştirmek için önceki ezberci öğrenme yöntemlerini değiştirmeye yönlendirebilir. Durumsal biliş ve öğrenme teorisine, durumsal öğelerin öğe niteliklerine ve hazırlık adımlarına göre, ders içeriğiyle birlikte, bu çalışma normal matematik öğrencileri için "Modern Eğitim Teknolojisi" dersi için yaratıcı bir şekilde bir dizi simüle edilmiş durumsal öğe tasarladı ve derledi ve elektronik bir değerlendirme sistemi geliştirmek için platformlar arası C ++ uygulama geliştirme çerçevesi kullanan Qt ve MySQL uyguladı. Bu sistem, dijital öğretim kaynakları sağlama, bilgi tabanlı öğretim tasarımı ve öğretim uygulama becerisi de dahil olmak üzere bilgi tabanlı öğretimde öğretimi desteklemek için teknolojiyi kullanma açısından öğrencilerin yeteneklerini inceleyebilir. Bu arada, öğrencilerin cevap verilerini otomatik olarak toplayacak ve bunları veritabanı sistemine yükleyecektir. Öğretmenlerin öğretimi iyileştirmek için verilere dayalı öğretim kararları alması uygundur. Bu araştırma, büyük bir uygulama değerine sahip olan simülasyon durumu değerlendirme yöntemini daha da teşvik etmektedir ve gelecekte bu alanda acilen daha derinlemesine araştırma ve keşiflere ihtiyaç duyulmaktadır.
Anahtar Kelimeler: yerleşik öğrenme; değerlendirme sistemi; bilgi öğretme becerisi

INTRODUCTION
With the continuous development and improvement of school education, it has gradually moved away from social life and has become the so-called "ivory tower". There seems to be a consensus that learning is something that

happens in the classroom, and that what used to be where learning primarily happens - social life is neglected instead. The latest round of curriculum reform is happening all over the world. The situational simulation teaching method is accepted by more and more teachers and students and is considered to be able to improve the teaching effect (Perin, 2011). The practice questions and tests after class should also be consistent with this practice. Students can solve problems in real situations, instead of blindly memorizing them. Therefore, the process of determining changes in student behavior in instruction through various measurements and systematic collection of data (Fry et al., 2008) should also be changed.

In today's drastic changes in the international situation, it's urgent to cultivate students' skills in the 21st century (González-Salamanca et al., 2020). The change of school education goals calls for the improvement of teachers' ability, especially the ability of informatization teaching, that is, the use of ICT to promote students' learning (Fernández-Batanero et al., 2020). This is the reason why major countries and international organizations in the world update the standards related to teachers' information technology capabilities all year round. However, if the level of informatization teaching ability of normal students cannot be effectively evaluated, it is difficult to get rid of blindness in the training work, and its effect cannot be guaranteed.

At this stage, the evaluation of normal students' informatization teaching ability is usually in the form of quantitative self-report and qualitative observation (Yusrizal et al., 2019). The two evaluation methods have their inherent defects. The former makes it difficult to assess students' ability to solve problems in real situations, and cannot avoid problems with participants' dishonesty or unclear self-perception. The latter is difficult to measure for a long time with large samples and cannot be applied to actual teaching evaluation. At the same time, the paper-and-pencil test method is not convenient for analyzing students' test data. As a low-fidelity simulation, the simulated situational test requires respondents to make hypothetical responses to a series of situational difficulties (Herde et al., 2019), which can effectively solve the existing problems.

Given this current problem, this research focuses on the technical support teaching part in the field of measuring normal students' informatization teaching ability, which is less researched on simulated situational tests. Based on the theory of situational cognition and learning, the elements attributes and preparation steps of situational test questions, programming technology, database technology, a set of simulated situational tests was designed and developed, and the application program is presented to the students as its carrier, to it is more convenient and effective to measure the technical support teaching ability of students' informatization teaching ability, and it is convenient for subsequent data analysis and processing to better improve teaching.

LITERATURE REVIEW

Situated cognition and learning theory

From behaviorism, modeled by the study of animal behavior in the early twentieth century, to Gestalt psychology, which emphasized the holistic nature of experience and behavior; to information processing theory, which emphasized memory and thought processes in the mid-twentieth century; learning theories have continued to be developed (Gao, 2001). But in the teaching model guided by these theories, students are separated from the real environment, knowledge, and behavior are separated, and schools focus on de-contextualized knowledge and well-structured problems. It is difficult for students to transfer what they have learned to reality in the world. Therefore, students with high scores own low abilities (Brown et al., 1989). Situational cognition and learning theory emphasize the powerful interaction process between knowledge and situation and gradually become the focus of learning theory.

The origins of the study of contextual cognition and learning theory date back to the late nineteenth century and have continued to develop to the present. As early as 1899, in School and Society, Dewey pointed out that life is the true educator and that hobbies learn from life itself, yet schools are disconnected from life and they are very isolated (Dewey, 1990). Subsequently, Whitehead referred to the knowledge that learners learn in school for exams only and not for solving practical problems as "inert knowledge"(Whitehead, 1967). Further, Riznick details the differences between daily life and school situations and shows that school education is individualized and abstract, while out-of-school learning is cooperative, situational, and concrete. Since then, she has published several books and played an important role in the development of situational cognition and learning theory. In 1989, Brown et al. published the paper " Situated cognition and the culture of learning", which was a relatively systematic and clear exposition of the theory of situational cognition and learning (Brown et al., 1989).

In the following decades, more and more scholars participated in the research and application of situational cognition and learning theory. The theory was continuously developed and improved, and its theoretical system was gradually formed. At the same time, the theoretical and practical research on situational cognition and learning has spread to other fields of education, including distance education, basic education, adult education, online

teaching, higher education, and so on (Wang, 2002). After more than 100 years of theoretical development, situational cognition theory has gradually moved from infancy to perfection. Now, situational cognition and learning theory has become important learning theory, which can provide effective learning and facilitate the transfer of knowledge to real life.

Simulated situational items

A mock situation test is a series of test questions that expose applicants to situations similar to what they might encounter in work or life to elicit how they would respond to these stimuli. Compared with non-situational questions, contextual questions tend to increase the difficulty of the questions while examining knowledge points or abilities and can make abstract questions concrete.

The simulated situation test is widely used in human recruitment. The candidates are placed in a specific pre-designed situation, and the recruiter observes, records, and analyzes the applicant's behavior and related information to assess the applicant's business ability (Schmitt & Ostroff, 1986). The researchers summarized the development process of the situational judgment test, which needed to go through three stages, including the development of stimulus materials, the development of response materials, and the development of scoring keys (Goldstein et al., 2017). In the selection of talents in nursing medicine, government departments, as well as in the field of psychological testing, the proportion of situational test questions is constantly increasing (Whetzel & McDaniel, 2009). For the field of education, simulated situational tests are more successful in the application of PISA. PISA items usually contain one or more questions in a situation, and the solution of the problem is contained in the situation, and it measures the ability of students to use intelligence to solve problems in a specific situation (Turner & Adams, 2007). PISA emphasizes that a situation is considered real when participants have experienced and practiced it in the real world.

Several studies have shown that simulated situational tests have high reliability and validity, and can effectively measure the ability level of participants. A study using simulated scenarios to create an assessment test tool, recruited 33 residents to perform a five-task simulation, suggesting that simulated scenarios can be used as a powerful tool for assessing surgical skill tool (Mannella et al., 2019). In addition, given the shortcomings of self-report evaluation methods in personality tests, some researchers have proposed the use of situational judgment tests to predict personality characteristics. Olaru used situational tests to measure personality, and the results showed that the use of situational tests to measure personality was psychologically reliable, further supporting that situational tests could effectively measure personality-related behaviors (Olaru et al., 2019).

However, there is currently a lack of research on applying simulated situations to measure pre-service teachers' information teaching ability. This study will design and develop an electronic evaluation system to test students' information teaching ability for a university's "Modern Educational Technology" course.

METHODS

Assessment framework

The evaluation question frame of this research comes from the technical support teaching module in the "Standards for Informatization Teaching Ability of Normal Students", which was promulgated by the research group "Empirical Research on Informatization Teaching Ability Standards and Training Models of Normal Students" on June 29, 2018. The technical support teaching module includes three aspects, namely, the provision of digital education teaching resources, the teaching design based on information technology, and the ability in the teaching practice process. Providing digital education and teaching resources refers to the ability to plan, produce, evaluate, optimize, manage digital education and teaching resources, and provide learners with personalized learning experiences and opportunities according to predetermined teaching situations. Informatization-based instructional design refers to mastering informatization instructional design models, principles, methods, strategies, evaluation methods, and related tools. The ability to master the teaching practice process refers to the applied skills that need to be mastered in the actual teaching process, including the use of information technology to track, analyze, evaluate and intervene in the teaching process

Situation selection

The context of the question should be the carrier of the idea and information of the question, not the context for the sake of the context. When designing a situation, first of all, the authenticity and scientific nature of the situation should be ensured, and no random fabrication is allowed. Secondly, the setting situation should be closely related to the content currently being examined. The ultimate purpose of setting the situation is to examine the ability of the subjects and to achieve the purpose of the test. While ensuring the above, try to be as novel as possible, which should be in line with the current social environment, but avoid blindly pursuing novelty that exceeds the cognitive level and experience of the subjects.

Based on the above considerations, the simulation situation of this research is: "If you are a junior high school mathematics teacher in a certain school, your class is about to start learning the unit "Parallelogram" in the second volume of the eighth grade, please combine your work in "Modern Educational Technology". The knowledge learned in this course is designed, developed, and organized to improve students' knowledge and skills, mathematical thinking, problem-solving skills, and emotions and attitudes.

Scripting

The content of the script is considered from the following perspectives: instructional goals, instructional contents, choice of instructional methods, instructional environment, instructional theory, instructional evaluation, development of teaching resources, search for teaching resources, and implementation of distance education.

The first thing you need to do is to write the objectives for the lesson, which are the results that the teacher expects to achieve through the lesson. Therefore, the teaching objectives are not written casually but follow certain writing rules. Nowadays, there are many methods of writing objectives, among which the ABCD method is most commonly used because of its easy-to-operate process.

You recall that parallelogram is not the first time that parallelogram appears in the textbook, and it is not the first time that students learn about parallelogram, in terms of the textbook that students have learned, the second semester of the first grade is the first acquaintance with parallelogram, the first semester of the fourth grade learns the concept of a parallelogram, the first semester of the fifth grade explains the area of a parallelogram in the second semester of the eighth grade, students will learn the properties of parallelograms, so what principle does this arrangement of teaching contents follow?

After analyzing the content of this lesson, you begin to design the teaching process. Recently, you have noticed that the students in your class are generally not interested in learning and have a lazy attitude in class, no longer listen to the teacher carefully, and are eager to be independent. Because the school has already popularized the electronic schoolbag, you intend to use a combination of online and offline ways to provide resources and activities related to the learning environment, students first use the resources in the electronic schoolbag, independent learning parallelogram knowledge in class time, for the pre-class questions left in class with the teacher and classmates to solve, give full play to the students' conscious initiative to learn, then you need to learn in this case Which teaching style's specific implementation plan?

In the process of learning how to implement the above teaching methods, you gradually find that the current classroom is not good enough to carry out this teaching method, and you recall the meeting before the principal said that nowadays the school strongly supports information technology teaching, providing a variety of teaching environments, in addition to the traditional chalk and blackboard classroom, there are classrooms equipped with projectors, teachers and students with a computer room classroom, and Where do you plan to implement the teaching of this lesson?

Many learning theories underlie your chosen teaching style: mastery learning theory, deep learning theory, primary learning theory, and active learning theory. Which theory emphasizes the need for students to understand how to use knowledge to solve real-world situations, and the teaching process focuses on the integrated application of knowledge and higher-order thinking activities, such as creative problem-solving? In the course of lesson planning, you feel more and more that you still have a lot to learn, especially in the area of technology support for teaching, but you don't know which areas to make up for, so a colleague suggests that you can refer to TPACK theory to help your professional development. What three areas of knowledge should you focus on learning and reserving according to TPACK theory?

Evaluation is an integral part of the teaching process, and there is a growing emphasis on not using scores alone to determine students' abilities, you have come to accept this view as you continue to learn and teach. There are many different types of evaluation, and you intend to use this type of evaluation, which is a comprehensive assessment of students' learning in the process of education and teaching, including the effectiveness of learning, the process, and the non-intellectual factors closely related to learning. It not only makes judgments and identifies problems in the quality of learners' learning, but also encourages students to reflect on the learning process to better understand the ways and means of mastering learning. Which type of assessment does it belong to?

After the initial design of this lesson, you start to create the teaching resources used in this lesson. The process of proving the median line theorem is abstract and not well understood by students with poor foundations. At this time, the mathematics teacher of another class has created his lesson materials for this lesson and then asked you to give him some suggestions. Why?

After your careful study and careful arrangement, the lesson went very successfully and was liked by the students. Some students even became very interested in the mathematical history behind geometric figures such as parallelograms and asked you about it, but if you did not know the relevant historical background, what are you going to do about it?

This concludes the lesson successfully. Although this lesson is the most energy-consuming since you have been working, it is also the most rewarding. But your good mood is spoiled by a sudden announcement that the local CDC has informed you that there is a confirmed local case in your school district, so the school intends to suspend offline classes and switch to online classes, but without limiting the specific teaching method.

Design items

First of all, a qualified test question should be logically rigorous, and the expression is clear and reasonable. Second, a situational test question should not only focus on the details, fragmentary knowledge points, and memorized knowledge in the textbook, but should pay more attention to the core concepts and knowledge content of greater value, and can also appropriately add some complex questions. Third, if a test question is still valid after being removed from the situation, it is not a qualified situational test question. The test question and the situation should be closely integrated, and formalism should be rejected. Fourth, for an excellent situational test question, students may not be able to easily solve the problem through memory but need a real understanding and mastery of knowledge to answer correctly. As for the sets of questions in the same situation, the questions should be coherent and intrinsically linked, and students should be guided step by step to explore the students' abilities and experience the process of integrated problem-solving. Therefore, based on the above principles of test question formulation, combined with the scenarios and scripts set up, as well as the important theoretical knowledge and skills of the "Modern Educational Technology" course, this research has designed 11 simulated situational questions, including 3 multiple-choice questions and 8 multiple choice questions, see Appendix A.

FINDINGS

Demand analysis

The purpose of this test platform development is that students can answer questions on the computer, teachers or school administrators can upload test question information and basic information about students from the background, download students' answers and final scores to enter the scoring system, or conduct subsequent data analysis. This design adopts the design mode of client and server, which is divided into front and back. The front is for the students being tested, and the back is for teachers or school administrators.

Database

The MySQL database is selected for this development, which has the advantages of free and low maintenance costs. Alibaba Cloud's relational database RDS (Relational Database Service) provides a stable, reliable, and elastically scalable online database service based on high-performance SSD storage and Alibaba Cloud distributed file system. RDS supports MySQL, PostgreSQL, PPAS, SQL Server, and MariaDB TX engines and provides a complete recovery solution. It has the following functions and features: a high-security level to ensure data security; simultaneous deployment in many places around the world; flexible product forms to meet the needs of multiple purposes; significantly reducing operation and maintenance costs. Therefore, the Alibaba Cloud Database RDS MySQL version was finally chosen for this development. Then, the conceptual structural design and logical structure design are carried out for students, items, and grades respectively.

Front-end development

The front-end development is carried out on Qt software, which realizes the login interface [Figure 1] and the answering interface [Figure 2]. The reason why Qt is chosen for software development is that Qt is a cross-platform C++ application development framework that can create and develop cross-platform GUI applications. Its biggest feature is "write once, compile everywhere" (Blanchette & Summerfield, 2006). Qt not only has a complete C++ graphics library, but also has gradually added network, database, XML libraries, in recent versions, which significantly improves Qt's ability to develop large-scale, complex, and cross-platform applications.

Figure 1. Electronic assessment system login interface and error warnings. a, Login interface. b, Warning if complete information is not entered. c, Warning if there is no student information in the database.

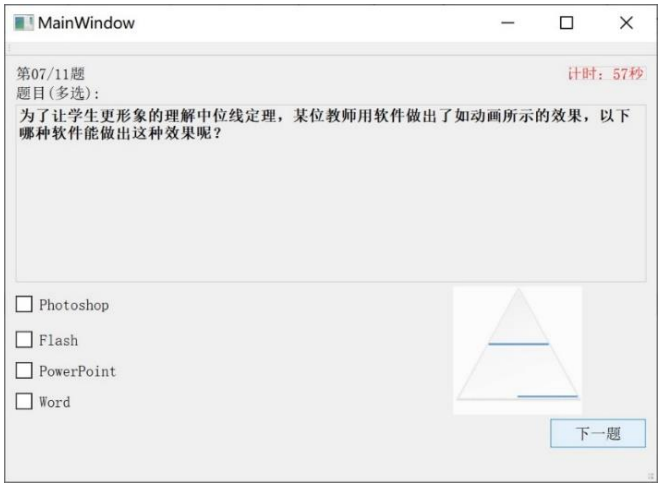

Figure 2. Question answering interface.

CONCLUSIONS AND EVALUATION

The ordering of simulated situational test questions is a lengthy and repetitive task. This time is mainly used to select the appropriate situation, create test questions in combination with the situation, maintain the consistency of the test questions, set the options, and express the language of the test questions. Therefore, in the teaching process, it is difficult for teachers to take the time to design simulated situational test questions when the task is heavy. However, evaluation is an important part of the teaching process. Only the implementation of evaluation reform can provide a clearer direction for teachers' classroom teaching and can guide students to change their previous rote learning methods and train higher-order thinking skills.

In the future, it is necessary to increase the proportion of test questions in simulated situations in the assessment, but schools should have specialized personnel to design related questions or complete the test question design through the cooperation of teachers under the premise of reducing teachers' work pressure. At the same time, question designers should receive relevant training exercises to avoid formal situational questions. At the same time, relevant departments can consider building relevant mock-scenario test question banks to directly provide front-line teachers for use

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Appendix A

If you are a middle school math teacher at a school and your class is about to begin a unit on parallelograms in the second book of Grade 8, please design, develop, and organize this lesson to improve students' knowledge and skills, mathematical thinking, problem-solving skills, and emotions and attitudes, taking into account what you have learned in the course "Modern Educational Technology".

1. ABCD goal formulation is a way of stating instructional objectives. According to ABCD goal formulation, which of the following instructional objectives presents all the elements of the statement? (Single choice)
A. By watching the animation, students can state the triangle median theorem accurately.
B. By exploring and proving, students can master the special properties of parallelograms with opposite sides to angles.
C. Students can write in detail the process of proving parallelograms based on the properties of parallelograms.
D. The teacher will be able to fluently state the characteristics of various properties of three special parallelograms.
2. For example, in the second semester of the first grade, parallelograms are introduced, in the first semester of the fourth grade, the concept of parallelograms is studied, and in the first semester of the fifth grade, the calculation of the area of parallelograms is explained, and in the first semester of the eighth grade, the properties of parallelograms are studied. (Multiple choice)
A. Spiral principle
B. Straight-line principle
C. Thoughtfulness principle
D. Expanding principle
3. For students to better master parallelograms, the teacher intends to use a combination of online and offline approaches to give full play to students' self-motivation in learning and to provide resources and activities related to the learning environment. Which of the following teaching approaches do you think meets the above requirements? (Single choice)
A. Individualized instruction
B. Blended Learning
C. Traditional classroom teaching
D. Task-driven teaching
4. To accommodate the teaching style of this lesson, the course is planned to be conducted in this environment: a learning space built up with the help of advanced computer technology, Internet of Things technology, and cloud technology, which enables human-environment interaction, thus facilitating communication, collaboration, and sharing, and promotes personalized, open, and ubiquitous learning. Which of the following is this type of teaching and learning environment? (Single choice)
A. Traditional chalk and blackboard classroom
B. Traditional classrooms with projectors
C. Computer room classroom with one computer for teachers and students
D. Smart classroom
5. Teaching requires students not only to memorize the properties and decision theorems of parallelograms but also to learn how to use what they have learned to solve real-world problems. The teaching process focuses on the integrated application of knowledge and higher-order thinking activities, such as creative problem-solving. This teaching philosophy is consistent with which of the following learning theories? (Single choice)
A. Mastery learning theory
B. Depth learning theory
C. primacy learning theory
D. Active learning theory
6. Based on TPACK theory, which of the following knowledge is required for teachers to teach the class well? (Single choice)
A. knowledge of educational research methods, knowledge of pedagogy, and knowledge of technology
B. Knowledge of subject content, knowledge of educational research methods, knowledge of pedagogy
C. Knowledge of subject content, knowledge of pedagogy, knowledge of technology
D. Knowledge of subject content, knowledge of educational research methods, and knowledge of technology
7. Evaluation is an integral part of the teaching and learning process, and there are various ways to evaluate, one of which is to make a comprehensive assessment of students' learning as education and teaching proceed, including the effectiveness of learning, the process, and the non-intellectual factors closely related to learning. It not only makes judgments about the quality of learning and identifies problems, but also encourages students to reflect on the learning process to better understand how and how to master learning. Which of the following belongs to this type of evaluation? (Single choice)
A. Diagnostic evaluation

B. Group evaluation
C. Summative evaluation
D. Process evaluation
8. To make students understand the median theorem more visually, a teacher used software to make the effect shown in the animation. Which of the following software can make this effect? (Multiple choice)

A. Photoshop
B. Flash
C. PowerPoint
D. Word
9. A teacher presented such a PowerPoint in a class. According to Meyer's multimedia learning theory, what mistake do you think he made? (Single choice)

A. No error
B. No focus
C. Appearing unrelated images
D. Contrary to the principle of temporal proximity
10. A student is particularly interested in the mathematical history behind geometric figures such as parallelograms and asks you about it, but you don't know the relevant historical background, what are you going to do about it? (Multiple choice)
A. Search for relevant knowledge through search engines such as Baidu
B. Ask expert teachers, seniors, and colleagues
C. Tell the students to master the knowledge of the textbook
D. Read relevant academic papers
11. Which of the following software can be applied if there is an outbreak at the school site and the school director requests that all courses be switched to online? (Multiple choice)
A. WeChat
B. Tencent Meeting
C. Ding Talk
D. QQ Classroom

A Study of Computer-aided Instruction and Competition Strategy toward Young Learners

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ABSTRACT
A purposive sampling was conducted with 109 students from Anding elementary school, Taiwan. First, we found perceived ease of learning, enjoyment, self-efficacy, social interaction and learning attitude have significant differences between integrated teaching approach and Spoon-feeding instruction in this study. Second, the research framework has been proven perceived ease of learning and enjoyment positively influence on self-efficacy and learning attitude. Furthermore, we have verified self-efficacy positively influence on social interaction. Moreover, social interaction positively influences on learning attitude. Two contributions are found in this study. First, we adopted the concept of open innovation to design digital orchid game and integrated teaching approach. Second, we verified the connections of the research model with great model fit.
Keywords: perceived ease of learning; enjoyment; self-efficacy; social interaction; learning attitude

INTRODUCTION

Interactive teaching instructions incorporating with technological supports may shed a light for students in Taiwan to increase learning attitude as well as gain practical competencies for the competitive twenty-first centuries. Enthusiastic and dedicated teachers have close observation on Taiwan education and pointed out the two major current problems of Taiwan education. First, Spoon-feeding instruction (SFI), intensive test measurements, and punishment systems may have entitled Taiwanese students' excellent performance on the pen-write test within a limited time in the past decades. Thus, most lecturers enjoy the past glories and enjoy adopting SFI as the main teaching instruction. However, it also has negative impacts on students' learning attitude and independent thinking competence in the long run. Second, young students of Taiwan borne in cyber age are raised and accompanied by tablets; therefore, on-line games and applications serve as key elements in their everyday life. Surrounding by the digital environment, those young learners use to receive information via visual and sound effects. Comparing to the interactive lecturing, tradition teaching approach such as SFI looks awkward and it makes those young students show less interested in classroom learning. Owing to the two critical reasons mentioned above, education in Taiwan gradually have lost their edge in the world. Fortunately, proactive teachers perceive the young students borne in cyber age fond of playing digital games. The attributes of those digital games comprise of ease of learning and enjoyment, which support young learners to gain self-efficacy, to participate social activities, and to improve learning attitudes. Therefore, we intend to design interactive and interesting curricula, which include attributes of computer-aided instruction and competition strategy to replace spoon-feeding instruction, to improve students' learning attitude.

The International Telecommunication Union (2012) indicated that technological learning plays as an important factor in education reform in some Asian countries. The development of telecommunication technologies has changed the directions of government education policies, especially in North East Asia. For example, Korea focuses on self-directed mobile learning projects (Lee, 2012). Japan is aimed at context-aware language learning projects (Ogata et al., 2010), and Taiwan is engaged in a national e-learning project (Huang & Tsai, 2011). The development and application of technology-enhanced learning using educational computer games have increased rapidly in the past decade (Hwang and Wu, 2012). Prior studies have emphasized the importance of technology in improving student attitudes toward learning (Davis, 1989) and performance (Brunner & Tally, 1999). Other study depicted that support from technologies will enhance learner participation in educational settings (McLoughlin & Lee, 2010). Owing to the mentioned above, the concept computer-aided instruction is considered the crucial element to inspire apprentices' learning attitudes. In order to have better teaching performance, we invite professors in orchid domain and engineers from Industrial Technology Research Institute (ITRI) to design an interactive orchid game as teaching material (Chesbrough, 2003). Besides, we also incorporate team mind mapping and a competition strategy in the digital orchid game to enhance self-efficacy via team brainstorming and to improve interpersonal skills via intensive social interaction. Finally, we expect the combination of teaching approaches might attract learner attention as well as provide a contribution to improvements in learning attitude. The further information of research theories and framework of Technology Acceptance Model will be discussed in the

following pages.

LITERATURE REVIEW

Theories and approaches

Computer-assisted instruction (CAI), which combines of text, graphics, sound and video, is an interactive instructional technique to facilitate and improve instruction. Anohina (2005) indicated that Computer-assisted instruction (CAI) acts as a supporting reaching approach to developing students' knowledge via activities. The advantages of CAI provide students one-to-one interaction, self-pacing, and self-directed learning. Prior studies have proven that support from computer programs helps students acquire both language and reading skills (Elena, Krueger, & Markman, 2004) better than traditional teaching (Lepper & Gutner, 1989). Therefore, interactive curriculum design such as computer-aided instruction facilitates students to gain attention and motivation through intensive interactions. Mind Mapping might be an efficient and feasible approach to support students to gain competence of logical reasoning competence in interactive curriculum. Biktimirov and Nilson (2006) stated that mind mapping, which involves the use of logical and systematic thought to express the imagination. Students gain knowledge and improve learning attitudes through transform individual thoughts into a diagram to communicate with the real world. For enhancing learning attitude, adding the element of competitive strategy into the new curriculum might be an excellent option to make students pay great attention in learning. Deutsch (1973) argued that competition strategy, which not only efficiently affect knowledge acquisition and transformation (Pe-Than, Goh, & Lee, 2014), but also enhance learning performance as well as motivation (Burguillo, 2010) is the act of attempting to gain achievements. The approaches of team brainstorming and competition may enhance learning attitudes but also incur quarrels and conflicts as well. In order to solve those challenges, we also adopt social learning theory, which puts great efforts on observing continuous reciprocal interaction among cognitive, behavioral, and environmental influences to explore the connections of the behaviors, attitudes, and emotional reactions of others (Bandura, 1977). Each mentioned teaching method had been proven on the improvement of learning attitude. Thus, this research intends to integrate the mentioned teaching approaches, named ITA, to develop a new curriculum and we expect the innovative curriculum does improve students' learning attitudes effectively and efficiently. In the following pages, we plan to discuss the elements of Technology Acceptance Model.

Modified Technology Acceptance Model (TAM)

Davis (1989) proved that perceived ease of learning and enjoyment both improve students' performance and learning attitude. Another study explained that perceived usefulness and ease of use have a positive influence on performance, attitude, and intention in the mobile technology context (Lu, Yao, & Yu, 2005). Additionally, enjoyment is regarded as an intrinsic factor that has a positive influence on attitude (Davis, Bagozzi, & Warshaw, 1992; Nysveen, Pedersen, & Thorbjørnsen, 2005). The reviews above indicate that perceived ease of learning and enjoyment not only indirectly increase learners' self-efficacy via obtaining excellent performance, but also improve their learning attitudes as well.

Furthermore, Bandura (1982) indicated that efficacy belief is the driving force that triggers motivation and influences how we think, feel, and associate with others. Self-efficacy has also been defined as when individuals have the ability to cooperate with partners for the purpose of completing appointed tasks (Bandura & Ozer, 1990). Hence, it has been verified that when students have greater self-efficacy, they will be more involved in social interaction with their peers to complete assigned homework tasks (Compeau & Higgins, 1995). Thus, the reviews above-mentioned show two connections, which are self-efficacy to social interaction and self-efficacy to learning attitude.

Moreover, social affordance is defined as when the curriculum design requires social interaction (Kreijins, Kirschner, & Jochems, 2002). Other studies indicate that mobile devices not only provide students with more opportunities to participate in learning activities (Roger et al., 2005), but also increase social interactions (Markett, Sanchez, Weber, & Tangney, 2005) and collaboration in the classroom (Lai & Wu, 2006; Schwabe & Goth, 2005). Tseng (2001) suggested that social interaction and self-recognition are motivations of users related to engagement in playing games (Tseng, 2001). Owing to the reviews, we may reason that social interaction have relationship with learning attitude.

To improve students' learning attitudes, we engage in new curriculum design in two directions. On one hand, we might presume that computer-aided instruction will improve students' learning attitudes via an ease of learning environment and an interactive interface. On the other hand, mind mapping incorporating competitive strategy will facilitate students to engage in intensive social interaction and collaboration as well as toward polishing their interpersonal skills and increasing self-efficacy. We expect that the curricula will make young learners experience

greater degrees of self-efficacy and social interaction as well as improvements in learning attitude. Consequently, we consider that designing an entertaining, interactive digital teaching curriculum might be the first stage to arouse students' learning attitude. The research questions addressed in this study include the following:
H1: The more perceived ease of learning that students feel via the integrated teaching approach, the greater self-efficacy that they will have.
H2: The more perceived ease of learning that students feel via the integrated teaching approach, the improvements of learning attitude that they will be.
H3: The more enjoyable the students feel via the integrated teaching approach, the greater self-efficacy that they will possess.
H4: The more enjoyable the students feel via the integrated teaching approach, the improvements of learning attitude that they will be.
H5: The greater self-efficacy that the students possess via the integrated teaching approach, the more social interactions through teamwork that they will engage in.
H6: The higher self-efficacy that students gain via the integrated teaching approach, the greater improvement of learning attitude it will be.
H7: The more social interactions that young students benefit from the integrated teaching approach, the greater improvement of learning attitude it will be.

METHODOLOGY

Case introduction

Anding Elementary School is located in agricultural county in southern Taiwan, Tainan. Like many present societies, children are unavoidable raised by tablets and the method of nurture without careful instruction may jeopardize young students' learning skills. Owing to the above mentioned, the principal and the teachers of Anding Elementary School considered improving students' learning attitude through integrated instruction. With a close observation of young students' attitude toward digital games, they found that learners showed great interest in interactive games. Most digital games are designed for younger users and have become a popular game industry in the 21th century. However, only a few games were designed for the educational domain especially for primary school students. Therefore, how to improve learning attitudes has become an important issue for teachers. Prior studies have indicated the importance of digital games in the younger generation.

For me, I am a researcher in education domain and a long-term observer of Anding Elementary School in teaching techniques. Teacher Chen, program initiator, invites me to participating the program of computer-aided instruction. We plan to select science classes as an experiment and the classes provide students required knowledge of growing plants. In order to make students enjoy in learning, we therefore designed an integrated instruction method including a digital orchid game, team mind mapping, and competition strategy. In conclusion, we anticipated that the orchid game will not only make young participants feel at ease in the digital learning world, but also will experience improvement in their degree of self-efficacy and social interaction. Finally, we expected that the new teaching approach would improve learning attitude of these students.

Curriculum design & teaching processes.

The goal of this enjoyable and ease of learning curriculum, exploring the cycle of orchid world, intends to train students to improve their self-efficacy, social skills, and learning attitude. To achieve the curriculum goal, five curriculum design processes are required. In the first step, we have to know young learners' learning attitudes toward computer games and the top five popular types of computer games played by young students. Recognition certain types of flower and understanding their life cycles through team discussions are the goals of step 2. In the third step, the orchid game was served as a teaching aid in classroom teaching and teammates must be familiar with the interface. Then, the knowledge of growing orchids in different phases, which include seed production, germination, seed formation, seed maturation, and flowering shown on figure 1. In the fourth step, through team information searching and intensive social interactions, students gain five stages of important knowledge of growing orchids such as seed production, germination, seed formation, seed maturation, and flowering. Additionally, they also attain the required knowledge of growing orchids during different phases like illumination, day temperature, night temperature, humidity, fertilizer, and watering. In the fifth step, the participating students have to key-in the proper answers of illumination, temperature, humidity, fertilizer, and watering in order to grow excellent orchids. This integrated instructional approach encourages learners to brainstorm and develop the proper ways to grow orchids through intensive social interaction in order to improve their interpersonal skills. In addition, the students gained heterogeneous competencies including information searching, oral expressions, and writing skills while they completed the assignment. Finally, the processes of this innovative curriculum improve not only students' self-efficacy and interpersonal skills, but also their learning attitudes. The detailed information was shown in table 1.

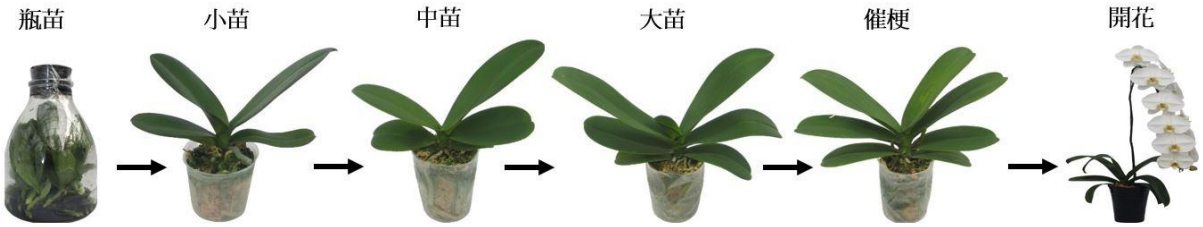

Figure 1. The processes of growing orchids

Table 1. Curriculum &teaching design

Steps	Curriculum goals/ teaching approaches
Step1	Influences of computer games on young learners/ Related information search Young learners' learning attitudes toward computer games Top five popular types of computer games played by young students
Step 2	Flower articles in the textbook/ Knowledge of flowers Recognition of flower types Understanding the life cycle of plants
Step 3	External resources (ITRI)/ Orchid game Orchid game serving as computer aids Knowledge of growing orchids in different phases Knowledge of seed production, germination, seed formation, seed maturation, and flowering
Step 4	Knowledge of orchid grown in different phases / Team information searching Searching the information of growing orchids in different phases in teams Requirements such as illumination, fertilizer, and watering for each phase in teams 3. Intensive social interaction through team knowledge sharing and discussions
Step 5	Orchid game competition/ Orchid knowledge application Key-in the proper answers of illumination, temperature, humidity, fertilizer, and watering

Game design

The concept for the digital orchid game comprises growing stages and conditions. The growing stages consist of five stages: seed production, germination, seed formation, seed maturation, and flowering. Moreover, six crucial requirements such as illumination, day temperature, night temperature, humidity, fertilizer, and watering must be considered in different cultivation periods. Providing orchids with the proper growing conditions at different growth stages poses a great challenge to students. Therefore, the orchid game was designed by stages, ranging from an easy level to a difficult one. Finally, we expect that the participants will experience enhanced self-efficacy and improved interpersonal skills through intensive social interaction and in turn will also develop improved attitudes toward learning. Figure 2 indicates the interfaces of each growing stage in the digital orchid game.

Figure 2. The interfaces of each growing stage in the digital orchid game

Procedure and samples

We plan to run both the research model and experimental design are examined in this study. In terms of the research model, we intend to investigate the connections in the research model, including the influences of perceived ease of learning and enjoyment on students' self-efficacy, social interaction, and learning attitude. In terms of the experimental design, we intend to examine whether the computer-aid instruction and spoon-feeding instruction exist differences; thus, we adopted t-test in this research. The examining processes are divided into two stages. In

the first stage, we asked the participants to fill out questionnaires without any instructions. In the second stage, the participating students experienced the integrated teaching approach. Then, the participants had to fill out the same questionnaires again. In this study, we also run t-test to examine whether perceived ease of learning, perceived enjoyment, self-efficacy, social interaction and learning attitude exist differences.

Our sampling of research model focused on fourth, fifth and sixth grade students in Anding primary school, Tainan. Three measurements were adopted in different periods to avoid common method variance. First, we hid reverse questions in the questionnaires. Second, two stages of filling out questionnaires were designed in the middle of semester and in the end of semester respectively. Finally, verifying discriminant validity exists in each construct. We only had 45 responses for polite study for examining consistency and developing corrected semantic and syntax. The survey took place from March 4th to 22th in 2019. With 109 questionnaires were filled out in class and 109 valid responses, 100 percentage of response rate. Figure 3 is the experimental procedure used in this study.

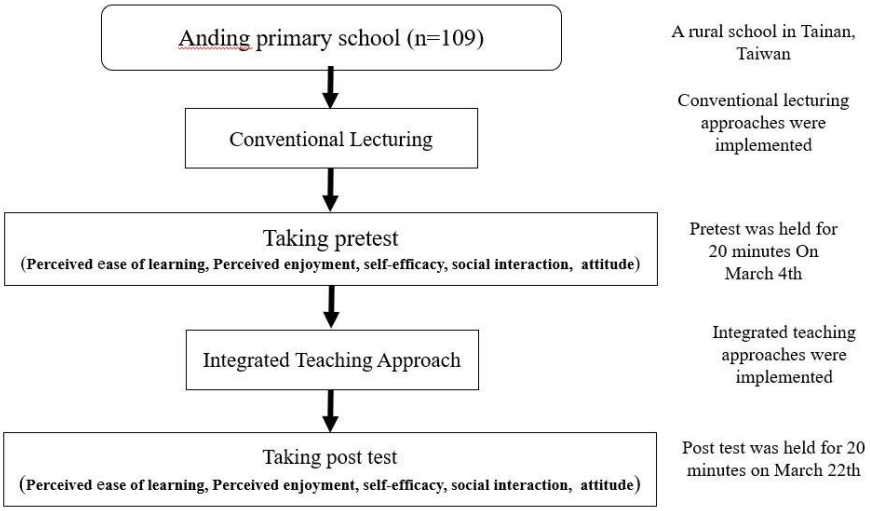

Figure 3. Experimental procedure

Operational definition

With regard to the purpose of facilitating perceived ease of learning and enjoyment, self-efficacy (Bandura, 1982), social interaction (V.D. Hoogen, Ijsselsteijn, & Kort), and attitude (Davis et al., 1992), a set of measurements associated with the learning acceptance model, were borrowed from the concept of TAM (Davis et al., 1992) for which the items were modified for the purposes of this study. The rubrics aimed at evaluating perceived ease of learning, enjoyment, self-efficacy, social interaction, and learning attitude (see table 2) were provided to both groups to help them review self-efficacy, social interaction, and learning attitude while learning. Pictures of lecturing students are provided in Figure 4.

Table2. Operational Definitions of Constructs

Operational Definitions
Perceived ease of learning: Sources: Davis (1989), seven-point Likert scale
POE1. The game is easy to learn. POE 2. The orchid game has an easy to use learning platform. POE 3. Users easily and vividly experience growing orchids in this game. POE 4. The interface of orchid game is user friendly. POE 5. The interactive model of the orchid game is easy to understand. POE 6. The learned knowledge from the orchid game can be easily transferred into growing real orchids.
Social Interaction: Sources: (V. D. Hoogen, Ijsselsteijn, & Kort, 2009), seven-point Likert scale
SI1. The orchid game is a multiplayer game. SI2. Discussing growing orchids with others polishes our skills while playing the orchid game. SI3. The orchid game can become a conversation topic with others. SI4. I can invite other people to play the orchid game with me. SI5. I can share orchid game information with others. SI6. I can exchange my experiences with growing orchids learned while playing the game with others.
Enjoyment Sources: Davis (1989), seven-point Likert scale

EJY1. It is interesting that the orchid game helps users experience the processes of growing virtual orchids. EJY2. It is interesting to experience growing orchids. EJY3. Controlling orchid growing conditions is interesting. EJY4. Playing the orchid game can help us enjoy learning to take good care of orchids. EJY5. Playing games and acquiring knowledge satisfies me. EJY6. I enjoy the process of growing orchids in virtual reality.
Self-efficacy: Sources: (Bandura, 1982), seven-point Likert scale
SE1. The orchid game helps us understand the orchid growth process. SE 2. The orchid game helps us learn the skills required to grow orchids. SE 3. The orchid game provides us with memory training. SE 4. Playing the orchid game is the first step of learning the use of a computer. SE 5. Playing the orchid game helps us kill time. SE 6. Playing the orchid game can be an interface for interactions among people. SE 7. The orchid game is a tool by which to acquire new knowledge.
Attitude Sources: (Davis et al., 1992), seven-point Likert scale
ATT1. I have intentions to play orchid game. ATT2. I will recommend others to play orchid game. ATT3. I will play the orchid game to learn how to grow orchids. ATT4. Before growing a real orchid, I will start to acquire knowledge by playing the orchid game. ATT5. I will grow orchids using the knowledge I got from the orchid game. ATT6. I will continue to be concerned about my progress in the orchid game.

Lecturing

Team discussion

Playing the orchid game

Figure 4. Content of orchid game

ANALYSIS AND RESULTS

Validity and Reliability

Some criteria for validity and reliability are given as follows: KMO >0.5, communality >0.5, eigenvalue >1, factor loading >0.6, Cronbach's alpha >0.7 and item-total correlation >0.6. The factor loadings for the four items of the attitude construct meeting the requirements were 0.86, 0.87, 0.88, 0.84, 0.80, and 0.86 (α=0.92). Independent variables: The five factor loading items for the perceived ease of learning construct were 0.78, 0.82, 0.85, 0.81, 0.86, and 0.82 (α=0.90). Six items for the enjoyment construct met the requirements, with factor loadings of 0.86, 0.88, 0.91, 0.90, 0.89, and 0.84 (α=0.94). Then, six modified items were used to measure social interaction, and all items with factor loadings of 0.91, 0.86, 0.90, 0.90, 0.90, and 0.78 (α=0.94) were retained. Seven items in the self-efficacy construct were modified, of which only three items SE1, SE2, and SE7 with factor loadings 0.84, 0.77, and 0.74 (α=0.86) were kept, as shown in Table 3. Then, the model fit based on the confirmatory factor analysis in this study was good, for which the figures were CMIN/DF=2.62, NFI=0.95, RFI=0.93, IFI=0.96, TLI=0.96, CFI=0.96, and RMSEA=0.07.

The convergent validity of a construct can be evaluated using two criteria: composite reliability and average variance extracted, which are required to be higher than 0.6 and 0.5, respectively (Fornell, 1981). The values for composite reliability in this study were 0.92, 0.95, 0.95, 0.82, and 0.94, and the AVE values were 0.67, 0.77, 0.76, 0.61, and 0.72. Both were higher than 0.6 and 0.5 respectively, shown on Table 2. Hair argued that the square root of the AVE should be at least 75% higher than the correlation coefficients among the constructs (Hair, Anderson, Tatham, & Black, 1998). The diagonal values were 0.82, 0.88, 0.87, 0.78, and 0.85, which were all higher than the correlation coefficients, as shown on Table 4; thus, the constructs showed good discriminant validity.

Table 3. Validity and Reliability

Construct	Items	Factor Loading	α	CR	AVE
Ease of Learning	POE1. The game is easy to learn.	0.78	0.90	0.92	0.67
	POE2. The orchid game has an easy to use learning platform.	0.82			
	POE3. Users easily experience growing orchids in this game.	0.85			
	POE4. The orchid game interface of is user friendly.	0.81			
	POE5. The interactive model for the orchid game is easy to understand.	0.86			
	POE6. The learned knowledge can be applied to growing real orchids.	0.82			
Enjoyment	EJY1. Experience the processes of growing virtual orchid.	0.86	0.94	0.95	0.77
	EJY2. It is interesting to experience growing orchids.	0.88			
	EJY3. Controlling orchid growing conditions is interesting.	0.91			
	EJY4. Playing the orchid game helps us take good care of orchids.	0.90			
	EJY5. Playing games and acquiring knowledge is satisfying.	0.89			
	EJY6. I enjoy the process of growing orchids in virtual reality.	0.84			
Social Interaction	SI 1. The orchid game is a multiplayer game.	0.91	0.94	0.95	0.76
	SI 2.Discussing orchid knowledge with others polishes social skills.	0.86			
	SI 3. The orchid game can be a conversation topic with others.	0.90			
	SI 4. I can invite other people to play the orchid game with me.	0.90			
	SI 5. I can share orchid game information with others.	0.90			
	SI 6. I can exchange my experiences with growing orchids.	0.78			
Self-efficacy	SE 1. The orchid game helps us understand the growing process.	0.84	0.86	0.82	0.61
	SE 2. The orchid game helps us learn the skills required to grow orchids.	0.77			
	SE 7. The orchid game is a tool by which to acquire new knowledge.	0.74			
Attitude	ATT1. I have intentions to play the orchid game.	0.86	0.92	0.94	0.72
	ATT2. I will recommend others to play the orchid game.	0.87			
	ATT3. I will play the orchid game to learn how to grow orchids.	0.88			
	ATT4. Before growing a real orchid, I will start to acquire knowledge by playing the orchid game.	0.84			
	ATT5. I will grow orchids using the knowledge I got from the orchid game.	0.80			
	ATT6. I will continue to be concerned about my progress in the orchid game.	0.86			

Table 4. Discriminant Validity

	Ease of learning	Enjoyment	Social Interaction	Self-efficacy	Attitude
Ease of learning	(0.82)				
Enjoyment	0.74***	(0.88)			
Social Interaction	0.72***	0.72***	(0.87)		

Self-efficacy	0.58***	0.71***	0.58***	(0.78)	
Attitude	0.73***	0.79***	0.84***	0.69***	(0.85)

Experimental results

Analysis of perceived ease of learning

Table 5 shows the descriptive statistics and independent-sample t test results for perceived ease of learning. The mean value and standard deviation in the post-questionnaire were 5.25 and 1.02 for the integrated teaching approach and were 3.34 and 0.82 with spoon-feeding instruction, respectively. Based on the independent-sample t test results, significant effects are found in perceived ease of learning ($t=17.56$, $p<0.001$). This suggests that the integrated teaching instructing young students how to play orchid game could make them feel easier than spoon-feeding instruction.

Table 5. Descriptive data and t-test in perceived ease of learning of the two groups

Experiment design	N	Mean	SD	Std. error	t
Spoon-feeding instruction	109	3.34	0.82	0.068	17.56***
Integrated teaching approach	109	5.25	1.02	0.085	

Analysis of perceived enjoyment

Table 6 shows the descriptive statistics and Independent-Sample T Test result of perceived enjoyment. Both of the mean value and standard deviations in post-questionnaire were 5.40 and 0.99 with the integrated teaching approach, and 3.01 and 0.41 with spoon-feeding instruction. From the Independent-Sample T Test result, significant effects are found in perceived enjoyment ($t=26.89$, $p<0.001$). This suggests that the integrated teaching instructing young students how to play orchid game could make them feel more enjoyable than spoon-feeding instruction.

Table 6. Descriptive data and t-test in enjoyment of the two groups

Experiment design	N	Mean	SD	Std. error	t
Spoon-feeding instruction	109	3.01	0.41	0.081	26.89***
Integrated teaching approach	109	5.40	0.99	0.034	

Analysis of self-efficacy

Table 7 shows the descriptive statistics and Independent-Sample T Test result of self-efficacy. Both of the mean value and standard deviations in post-questionnaire were 5.76 and 0.95 with the integrated teaching approach, and 2.95 and 0.68 with spoon-feeding instruction. From the Independent-Sample T Test result, significant effects are found in self-efficacy ($t=29.60$, $p<0.001$). This suggests that the integrated teaching instructing young students how to play orchid game could make them increase more self-efficacy than spoon-feeding instruction.

Table 7. Descriptive data and t-test in self-efficacy of the two groups

Experiment design	N	Mean	SD	Std. error	t
Spoon-feeding instruction	109	2.95	0.68	0.056	29.60***
Integrated teaching approach	109	5.76	0.95	0. 079	

Analysis of social interaction

Table 8 shows the descriptive statistics and Independent-Sample T Test result of social interaction. Both of the mean value and standard deviations in post-questionnaire were 5.00 and 1.14 with the integrated teaching approach, and 3.21 and 0.65 with spoon-feeding instruction. From the Independent-Sample T Test result, significant effects are found in social interaction ($t=16.25$, $p<0.001$). This suggests that instructing young students how to play orchid game could make them have the same topic of growing orchid. Thus, those students have more discussions and social interactions with classmates than spoon-feeding instruction.

Table 8. Descriptive data and t-test in social interaction of the two groups

Experiment design	N	Mean	SD	Std. error	t
Spoon-feeding instruction	109	3.21	0.65	0.054	16.25***
Integrated teaching approach	109	5.00	1.14	0. 094	

Analysis of attitude

Table 9 shows the descriptive statistics and Independent-Sample T Test result of attitude. Both of the mean value

and standard deviations in post-questionnaire were 5.06 and 1.15 with the integrated teaching approach, and 3.29 and 0.73 with spoon-feeding instruction. From the Independent-Sample T Test result, significant effects are found in attitude (t=15.56, p<0.001). This suggests that the integrated teaching instructing young students how to play orchid game could make them have positive learning attitude on orchid game than spoon-feeding instruction.

Table 9. Descriptive data and t-test in attitude of the two groups

Experiment design	N	Mean	SD	Std. error	t
Spoon-feeding instruction	109	3.29	0.73	0.060	15.56***
Integrated teaching approach	109	5.06	1.15	0. 095	

Results of the Research Model

The VIF values were below 10 (Neter, Kutner, Nachtsheim, & W., 1996) which verified no issue of multi-collinearity in this research model. In addition, those figures showed good model fit of Structural Equation Models were as following: CMIN/DF=2.72, NFI=0.81, IFI=0.88, TLI=0.86, CFI=0.88. The results of the regressions were illustrated as follow: Firstly, perceived ease of learning had significant influence on self-efficacy (β=0.25，p＜0.01) and attitude (β=0.19，p＜0.01) so hypothesis 1 and 2 were supported. Secondly, enjoyment had positive influence on Self-efficacy (β=0.83，p ＜0.001 and attitude (β=0.41，p＜0.01); therefore, hypothesis 3 and 4 were supported. Thirdly, Self-efficacy had positive influence on Social Interaction (β=0.75，p ＜ 0.001); hence, hypothesis 5 was supported. Furthermore, we also found out that social interaction had positive influence on Attitude (β=0.57，p ＜ 0.001); therefore, H7 was supported. However, it showed no significant influence between self-efficacy and attitude (β=0.03，p > 0.05); thus, H6 was not supported. Finally, the results of research model were shown on figure 5 and table 10 respectively.

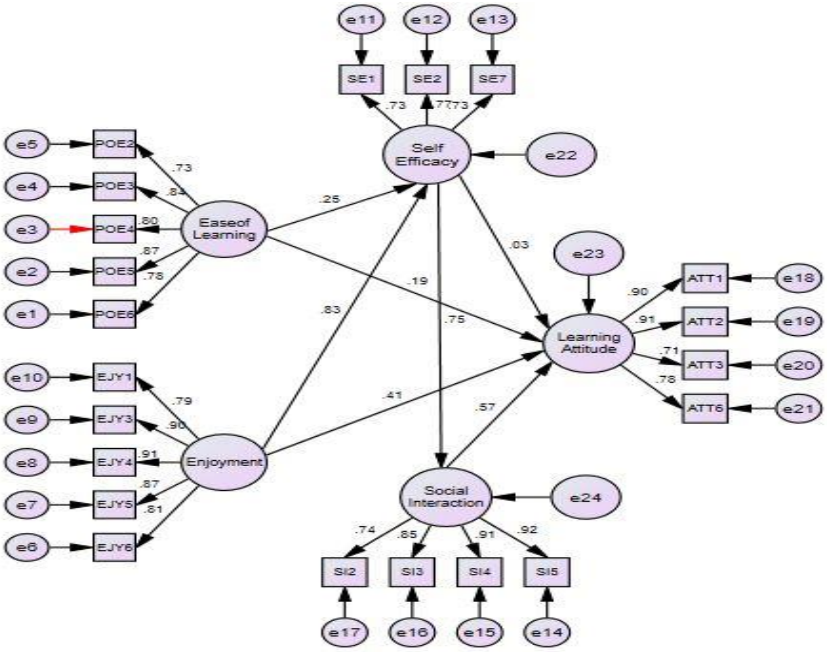

Figure 5. The results of framework

Table 10. Results of Hypothesis

	Hypothesis	Results
H1	The more perceived ease of learning that students feel via the integrated teaching approach, the greater self-efficacy that they will have.	Supported
H2	The more perceived ease of learning that students feel via the integrated teaching approach, the improvements of learning attitude that they will be.	Supported
H3	The more enjoyable the students feel via the integrated teaching approach, the greater self-efficacy that they will possess.	Supported
H4	The more enjoyable the students feel via the integrated teaching approach, the improvements of learning attitude that they will be.	Supported
H5	The greater self-efficacy that the students possess via the integrated teaching approach, the more social interactions through teamwork that they will engage in.	Supported

H6	The higher self-efficacy that students gain via the integrated teaching approach, the greater improvement of learning attitude it will be.	Not Supported
H7	The more social interactions that young students benefit from the integrated teaching approach, the greater improvement of learning attitude it will be.	Supported

CONCLUSIONS

We introduce open innovation which incorporate experts from ITRI, National Cheng Kung University (NCKU) and primary school. Having further discussions, the contents of orchid game with those heterogeneous specialists. A cycle of growing orchid becomes the theme of this digital game. Each participating member put great efforts on their domains. The engineers from ITRI engage in orchid game design and the professors from NCKU supported the primary school teachers to work on curriculum design. Figure 6 indicates the open concept of interdisciplinary team in this study.

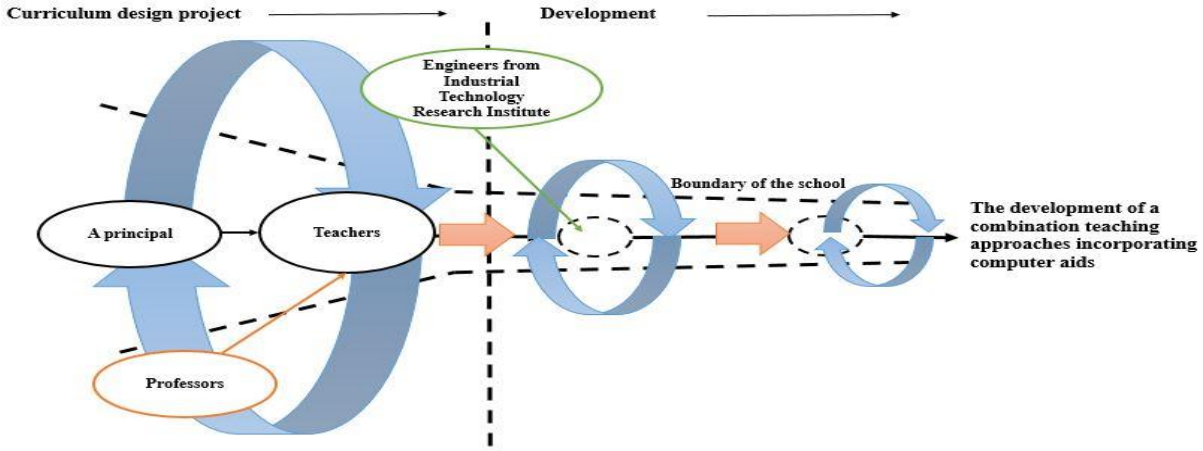

Figure 6. The processes of the open interdisciplinary team

This research aims at exploring how perceived ease of learning, enjoyment affect self-efficacy, social interaction and learning attitude in the interactive orchid digital games. Regressions and T-test are both implemented in this study. In the regression aspect, the results firstly indicate that perceived ease of learning and enjoyment have positive connections with self-efficacy and learning attitude. Secondly, those learners gain great self-efficacy via sharing orchid knowledge with teammates. It proves that self-efficacy has positive connections with social interaction. The learning approach benefits students in two sects, cycle of growing orchids acquisition and interpersonal skill improvement. Finally, the results also reveal intensive social interaction might affect those participating pupils' learning attitudes. In conclusions, these findings have verified Technology Acceptance Model (Davis et al., 1992) is helpful while adopting interactive digital games as teaching aids in classroom. In the t-test aspect, the results indicate that perceived ease of learning, enjoyment, self-efficacy, social interaction and learning attitude have significant differences between the integrated teaching approach (ITA) and spoon-feeding instruction (SFI) in this study. The students receiving SFI have less interested in curriculum. However, the students receiving ITA show great interested in the orchid knowledge acquisition.

Via close observations, the results show that the integrated teaching approach has positive influences on students in the five aspects. In the aspect of perceived ease of learning: Those participants consider that the orchid game is easy to learning and the interfaces of the platform is friendly. Besides, the game provides users vivid experiences of growing orchids. In the aspect of perceived enjoyment: The students feel that understanding the key knowledge growing orchids is interesting and seeing the orchids taken good care in different stages on computer screen makes those students satisfied. In the aspect of self-efficacy: The orchid game helps students learn the required knowledge to grow orchids in different stages and the learned knowledge can be easily transferred into growing real orchids. In the aspect of social interaction: The orchid game can become a conversation topic among classmates and the participating students can also share information of growing orchids with others. After gaining a systematic knowledge of growing orchids, students can easily complete the challenges of growing orchid. Thus, the intensive activities of orchid information sharing make students immerge in positive social interaction. In the aspect of learning attitude: Since the students have learned knowledge of growing orchid via digital games, they constantly ask teachers to provide other digital education materials for classroom learning; besides, the students also promote the advantages of digital games brought to them. The moves show that computer-aided instruction may have great possibility to change those participants' learning attitudes.

Four findings are in this study. First, game attributes of ease of use and enjoyable orchid game open a door for

students with great learning attitude to access orchid knowledge. Second, competition strategy and game attributes make students enthusiast to search the orchid information on website and discuss with team members for developing best answers. Third, via group mind mapping instruction to gain orchid knowledge such as humidity, temperature and nutrient soil, the hardworking on orchid knowledge acquisition make them gain great achievement. The achievements include self-efficacy enhancement, interpersonal skill polish, and learning attitude improvement during teamwork information searching processes. Fourth, the integrated teaching approach also facilitates those learners to increase learning students' attitude through intensive social interaction. Interesting and interactive instruction makes students not only gain practical competencies, but also experience the processes of knowledge management including knowledge searching, sharing, acquisition, accumulation, integration, and application about orchid knowledge. Through participating these curricula, students gain competencies of critical thinking & problem solving, cooperation, adaptation, information search & analysis, oral expression & writing skills and imagination. The detailed information is shown on figure 7 and table 11. The findings may suggest that incorporating ease of learning and enjoyable interactive contents will enhance students' self-efficacy, polish social skills and increase learning attitude.

Two contributions are found in this study. First, we adopted the concept of open innovation to design digital orchid game and integrated teaching approach. Second, we verified the connections of the research model with great model fit. In conclusions, this study has found that participating students pay great learning attitudes in classroom learning. It should be noted as a small-scale investigation on integrated teaching approach adoption and we will feel pleased to see the new teaching approach to implement in junior high and senior high school in Taiwan.

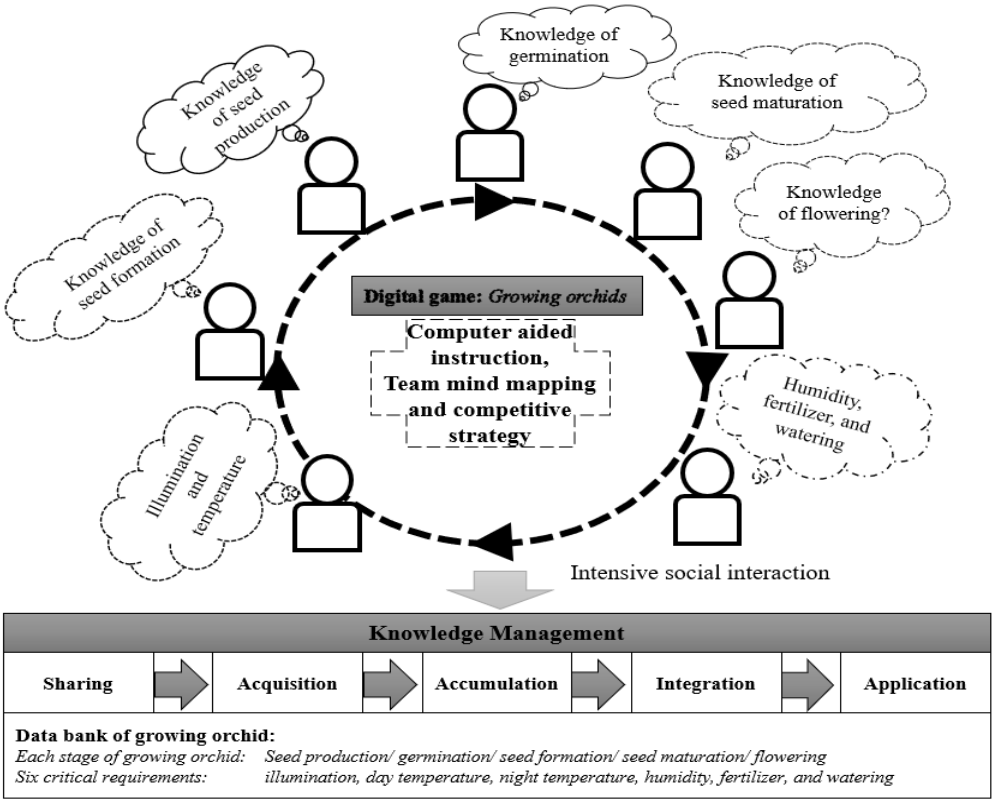

Figure 7. The processes of growing orchid knowledge via team mind-mapping

Table 11. The processes of knowledge management and competence acquisition

	Searching	Sharing	acquisition	accumulation	integration	Application
Knowledge management	Information: ● Orchid life cycles ● knowledge of growing orchids in different	Information: Information sharing ●seed production ●germination ●seed formation ●seed	Data: Obtain individual data sharing by team mind mapping	Data: Deposit the multi-knowledge into brains	Data: Withdraw each individual knowledge and integrate them into module knowledge	Feasible solutions: Use the knowledge of growing orchids to play the orchid game

	phases	maturation ●flowering ●illumination ●day temperature ●night temperature ●humidity ●fertilizer ● watering		
Competence acquisition	Information searching and analysis/ imagination	Competencies of Interpersonal skills: Critical thinking/ Oral & writing/Cooperation/ Adaptation/ interpersonal skills	Innovative module orchid knowledge	Problem-solving Improvements of self-efficacy, social interaction and learning attitude

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Analysis of International Students' Math Course Achievement in Higher Education: The Case of Sakarya University of Applied Sciences

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ABSTRACT
This study investigated the academic success of international students who took the course MAT 111 coded Mathematics 1 offered in the Fundamental Sciences of Engineering Departments of Sakarya University of Applied Sciences (SUBU) Faculty of Technology (TF), a state university in Turkey established in 2018, in the fall semester of 2021/22. The end-of-semester grades of all students from SUBU Student Affairs Office and data from SUBU International Student Center were used as data. In the final section, the success status of national and international students is discussed, and suggestions are made for possible failures of international students due to adjustment and mathematical literacy.
Keywords: International students in higher education, academicals success, engineering mathematics, mathematics education.

INTRODUCTION

Nowadays, technological developments affect the educational sector as much as any other. The Covid-19 pandemic, which has affected the whole world, has caused all levels of education to adapt to online education platforms in a short period of time, not only in Turkey but all over the world, as face-to-face teaching has been eliminated. Although online education is not as efficient as face-to-face education in terms of motivation and quality, the adaptation process has been beneficial, at least in terms of the use of technology, as continuous training is necessary.

Students can continue their education both abroad and at home, with the bachelor's, master's and doctoral programs offered by universities, as well as international exchange programs (Erasmus+ and Mevlana Exchange Programs). For this reason, universities create an educational market in the globalized world, especially with their academic achievements, the needs of their location region and the diversity of programs compatible with the industry. International students are an important part of this educational market.

In this sense, Turkey has become an education and training center for international students in recent years. Therefore, the search for a common market in the economic sector has begun to extend to the educational sector, and the movement of international students is an important pillar of this market. The growing number of international students studying at almost all Turkish universities can therefore contribute to the socio-cultural and economic life of the city in which they live.

In particular, international students who have studied at universities like SUBU that implement the +1 internship model (https://kesfet.subu.edu.tr/tr/node/846) can connect and collaborate with the company where they are doing their internship when they return to their country. By learning about our country and culture, they have the potential to volunteer and form a network with students from different countries with different geography and different identities based on the friendship they made during their education.

International student mobility started in 1981 with the Examination for Foreign Students (YOS), which was organized for those who want to pursue higher education in Turkey with their own resources (Kıroğlu, Kesten & Elma, 2010). In addition, this program consists of students from Turkish republics, Turkish and related communities, Turkish Higher Education Council (YÖK) scholars, students supported by the Islamic Development Bank, and students coming through exchange programs (mutually agreed students) (Şahin & Demirtaş, 2014). In addition, YÖK has started to introduce MYOS, the central examination for foreign students, instead of YOS from 2023, and is planning to introduce additional conditions for the admission of international students in some departments.

Universities must be able to easily handle the increasing number of international students. It is important that these students do not compromise the quality of education and behave fairly in adjusting and participating in courses. It should not be forgotten that it is necessary to cope, manage and control the work without affecting the performance and satisfaction of the university staff (Yıldıran, Özkan & Büyükyılmaz, 2016). Therefore, it has been proposed to create a platform for lecturers where instant and quick communication is possible in digital environments, where problems are communicated and solutions are worked out, and where functional seminars based on online or face-to-face experience are conducted by competent people (Erol, 2021).

In this study, the success rates of international students who took the course MAT 111 coded mathematics 1 of SUBU TF Computer, Mechatronics, Mechanical Engineering, Electrical Engineering-Electronics, Civil Engineering, Metallurgy, and Materials Engineering in the fall semester 2021/22 were investigated and also analyzed based on their countries and compared with national students. Conclusions and recommendations are then given in the last section.

To this end, the research problem was set as follows: "Does the MAT 111 coded mathematics 1 course success rate of international students at Sakarya University of Applied Sciences show a statistically significant difference compared to the general levels of classes?" An attempt was made to find answers to this problem by creating the following sub-problems:

1. Success rates of international students MAT 111 coded mathematics 1 course,
2. Success rates by gender,
3. Success rates of international students by country,
4. Comparison of success rates of national and international students.

METODOLOGY

Purpose and Contribution of the Study

Viewing mathematics as a subject that all students struggle with can make it difficult for international students to succeed because they are being taught in a culture and language different from their native language. Therefore, the aim of the study in this article is to compare and analyze the mathematical competencies of international students in different subject areas of TF on a country-by-country basis and in general. It is expected that a study to be conducted for this purpose will provide the necessary evidence to determine whether mathematics education should be provided in addition to Turkish education for international students who choose Turkey and SUBU in particular, in order to improve the current situation and to obtain education in the future.

Population and Sample

The population of the study consists of international students studying at the TF engineering departments of SUBU. According to the SUBU Student Affairs Department, there are 205 international active students who took the course MAT 111 in the fall semester of the academic year 2021/22. In this article, this study was used as an examination of the success and failure rates of these students at the end of the semester.

Data Collection and Analysis Method

The content of the MAT 111 coded course to collect data is:

- Basic concepts of mathematical analysis,
- Concepts of sets and numbers,
- Functions and special functions,
- Limit concept, right and left limits,
- Continuous functions and properties,,
- The concept of the derivative
- Higher order derivatives,
- Geometric and physical meaning of derivatives, derivative theorems,
- Indefinite forms,
- Curve drawings corresponding to the distribution of the main title and
- Comprehensive knowledge of mathematics, science, and related engineering disciplines; ability to apply theoretical and applied knowledge in these areas in solving complex engineering problems,
- Ability to identify, formulate, and solve complex engineering problems; ability to select and apply appropriate analytical and modeling methods for this purpose.

In accordance with the learning objectives, the general achievement lists and general program outputs obtained through the SUBU student affairs system and the SABIS information system (https://sabis.subu.edu.tr/) were evaluated. These general lists were analyzed based on international students and a frequency analysis was applied.

FINDINGS

This section presents findings and opinions about the success of international students in engineering departments at SUBU TF.

Mathematics 1 course success levels of international students

The success rates of international students who took the Mathematics 1 course coded MAT 111 in the fall semester of the 2021/22 academic year are shown in Figure 1.

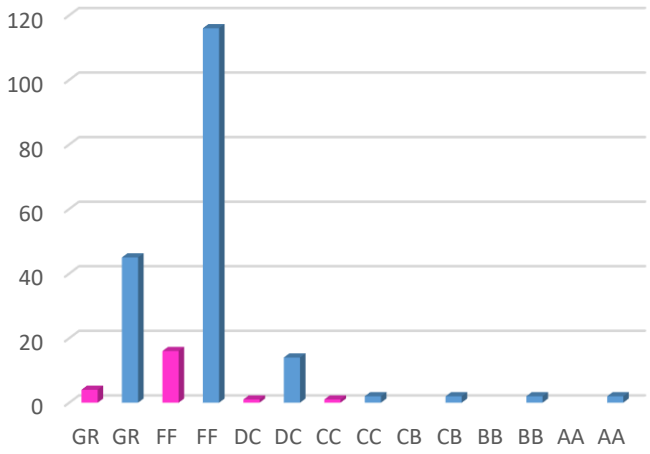


Figure 1. Semester success grades of international students in MAT 111

In Figure 1, blue colors represent male students and pink colors represent female students. End-of-semester success rate of 205 international students who participated in the course;

- 49 students who did not take the course, with GR,
- 132 students who failed the course with FF,
- 15 students with a grade of DC,
- 3 students with a grade of CC,
- 2 students with the grade CB,
- 2 students with the grade BB,
- 2 students with the grade AA

occurred in the form.

Achievement levels by gender

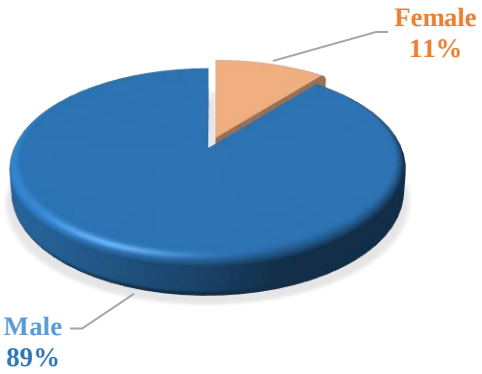
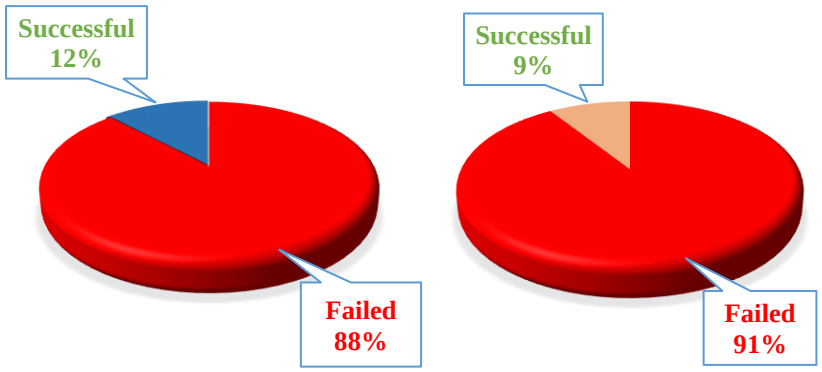


Figure 2. Distribution of total international students by gender

Of the 205 international students who took the MAT 111 course at SUBU TF in the fall semester of the 2021/22 academic year, 22 (11%) were female and 185 (89%) were male (Figure 2).



(a) (b)

Figure 3.a) Success rate of male students, b) Success rate of female students

Overall, as shown in Figure 3(a) and (b), 161 of 185 male students, (88%) were unsuccessful and 24 (12%) were successful; 20 of 22 female students, (91%) were unsuccessful, 2 (12%) were successful.

Achievement levels by country

The density of the 205 international students from 32 different countries, Faculty of Technology of the SUBU, who took the course MAT 111 is distributed as shown in Figure 4.

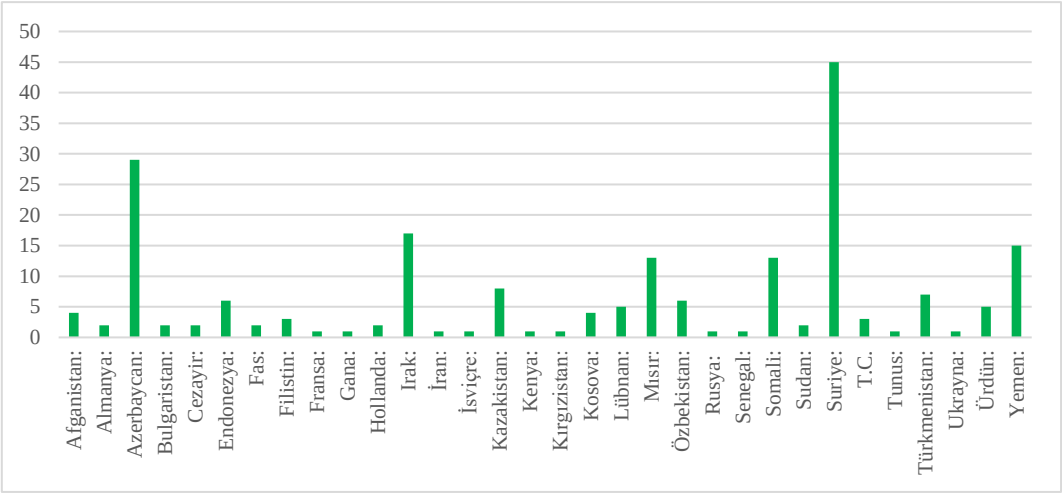


Figure 4. Density of 205 international students taking MAT 111 course by country

As shown in Figure 5, 181 of these 205 international students, or 88%, failed the course MAT 111.

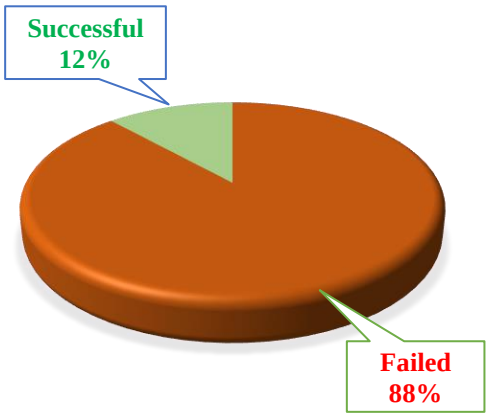


Figure 5. General success status of international students at the end of the semester

If we analyze the success situation using the countries of Azerbaijan, Syria, Iraq, Yemen, Egypt and Somalia, where there are many international students:

- 26 out of 29 Azerbaijani students are unsuccessful, 3 are successful,
- 37 out of 45 Syrian students are unsuccessful, 8 are successful,
- 17 out of 17 Iraqi students are unsuccessful,
- 13 out of 15 Yemeni students are unsuccessful, 2 are successful,
- 10 out of 13 Egyptian students are unsuccessful, 3 are successful,
- 13 out of 13 Somali students are unsuccessful, 0 are successful.

Thus;

- The success rate of students from Azerbaijan is 10%,
- The success rate of Syrian students is 18%,
- The success rate of students from Iraq and Somalia is 0%,
- The success rate of Yemeni students is 13%,
- The success rate of Egyptian students is 23%.

Comparison of national and international students' achievement status

As can be seen in Figure 6, a total of 950 students, 205 international and 745 national, are enrolled in the MAT 111 course at SUBU TF in the fall semester of 2021/22.

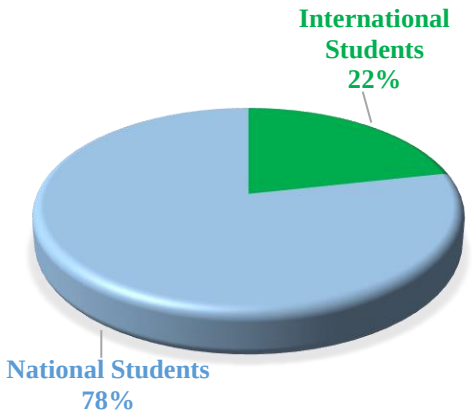


Figure 6. Rates of National and International students

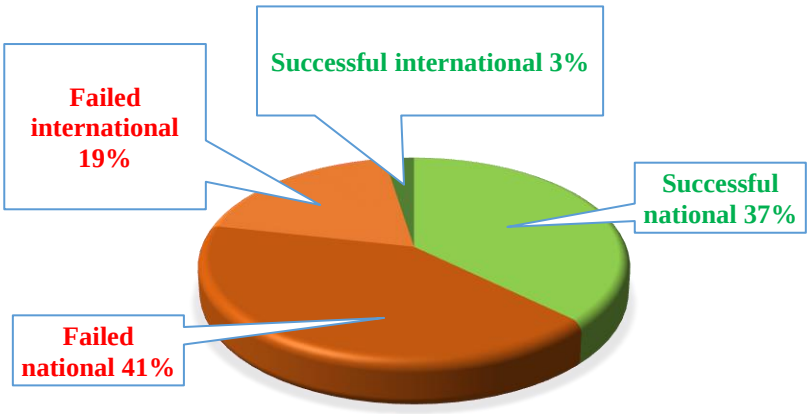
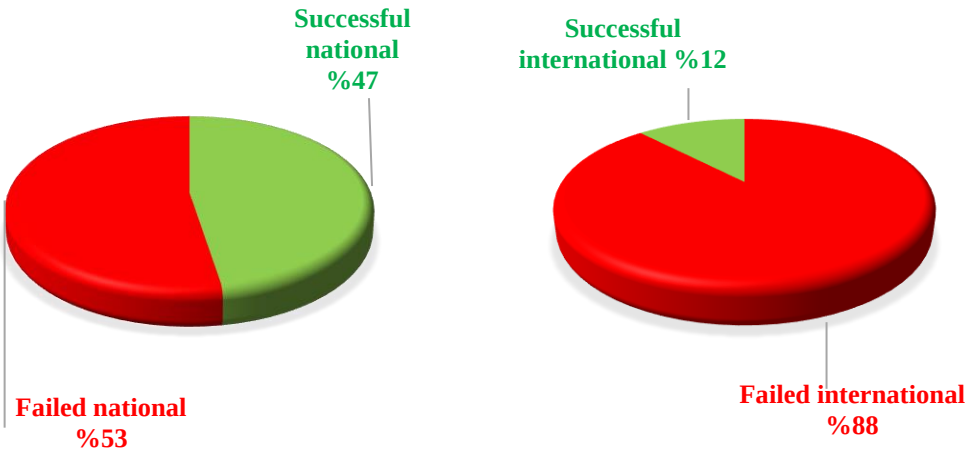


Figure 7. Comparison of national and international students' success rates

Figure 7 shows the success rates of the Mathematics 1 course, coded MAT 111, in which 383 of 745 national students and 24 of 205 international students were successful. This shows that the success rate for national students is 47% (see Figure 8), while for international students it is very low at 12%. Although the success rate of national students is 47% (see Figure 8), it is very low for international students at 12%. Although the success rate for national students is 47% (see Figure 8), it is very low for international students at 12%, for international students at 12%.



(a) (b)

Figure 8. (a) Success rates of national students, (b) Success rates of international students

CONCLUSION AND SUGGESTIONS

It is obvious that international students will contribute not only in education but also in the economy of our country, in accordance with the policies implemented by YÖK. Therefore, the quality of education should be kept high by increasing both the quality and quantity of international students.

With this study, which was conducted to determine the success status of international students studying the MAT 111 coded Mathematics 1 course at Sakarya University of Applied Sciences Faculty of Technology, the students' basic mathematical background, success level, and skills in the course were investigated.

With these considerations, our study was conducted with the success of 205 international students from 32 different countries who took the course MAT 111 coded Mathematics 1 in the fall semester of the academic year 2021/22 at the Faculty of Technology of SUBU TF.
As shown in achievement levels by country section, it is very thought provoking that the success rate of students from Iraq and Somalia is 0%. The fact that the maximum success is 23% suggests that some action should be taken to increase these success rates.
As it can be seen from our study, in case of 88% failure in Mathematics 1 course in the fall semester of 2021/22, it is necessary to prepare the education with basic academic courses in Turkish language.
The universities, which are especially concerned about the number of international students, have to work very sensitively. For this purpose, this study is extended by applying it to about 2800 international students of all faculties and departments of SUBU. In this way, an overall impression for all international students will be obtained and the student placement policy will be reviewed more clearly.

ACKNOWLEDGMENT

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Analysis of the Relationship between Online Learning Activities and Academic Achievement of Physical Education and Sports School Students

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ABSTRACT
This research, which was performed in order to determine the relationship between some activities in the online learning environment and their academic achievements of Physical Education and Sports School students, was designed in a relational scanning model. The research was conducted on the data of 444 students who attended online classes at a physical education and sports school of a state university in the spring term of the 2020-2021 academic year. Data used in the research were collected through "Aid for Learning Management System (ALMS)" and "Student Information System (SIS)" of the relevant university. The duration of watching the courses live and from the archive, the number of downloading the course documents and the duration of watching the course videos uploaded were obtained within the scope of online learning activities via ALMS; and the academic achievement scores of the students for these courses were obtained via SIS. As a result of the research, a positive and significant relationship was found between course attendance, the duration of watching the archived and uploaded course videos, the number of downloading course documents and students' gender and their academic achievement scores while there was no significant relationship between students' grade level and academic achievement scores. According to the significant correlations, it was seen that the duration of live course attendance and watching from the archive significantly predicted the academic achievement scores of the students while the duration of watching the course videos, the number of downloading the course documents and gender did not significantly predict the academic achievement scores of the students.
Keywords: Academic Achievement, Activity, Physical Education and Sports, Online Learning, Student

INTRODUCTION

The Covid-19 pandemic, that occurred on a global scale, has deeply affected the education system due to its basic input and output being human and its close relationship with other social systems. In this process, the distance education method, which has systematically existed for a long time, gained importance and the sustainability of education and training activities was ensured with the compulsory distance education system in all education levels from basic education to higher education. Distance education is defined as an education system in which individuals who are physically far from each other come together through technology tools and applications, and interaction is established by providing time and space flexibility (Aydemir, 2018). Distance education is a planned educational process in which the learner and the teacher are physically far from each other and connect with each other through communication technologies with online learning content (Rovai and Downey, 2010; Simonson et al., 2011). Today, we come across different forms of distance education applications such as web-based education, e-learning, mobile learning and online learning with the development and spread of information and communication technologies, and these concepts are sometimes used interchangeably (İşman, 2011; Özgöl et al., 2017). In this regard, online learning being a new form of distance education is defined as learning environments where learners and teachers can communicate and interact simultaneously (synchronously) or asynchronously, and absorb the necessary knowledge and skills through the Internet (Chang, 2003; Moore et al, 2011; Morrison, 2003).

Online learning has become the most preferred method in education because of the flexible learning it provides for students and instructors at any time regardless of physical location (O'Lawrance, 2005). Courses in online learning can be performed synchronously and asynchronously. Synchronous courses are those that provide an online learning environment where students and teachers interact by sharing audio and video in different places at the same time while students can access the teaching content by taking part in the education process at different times and in different places, independently of the teacher in the asynchronous courses (Erfidan, 2019; Yıldırım, 2020). Courses can be conducted through "Learning Management Systems (LMS)" by using such software applications as Adobe Connect, Zoom, Moodle, Canvas, Microsoft Teams, Skype, Blackboard, Big Blue Button, Google Meet and Perculus within the scope of online learning. LMS appears as software applications developed for the execution, documentation, monitoring, reporting and automation of training programs and courses (İzmirli and İzmirli, 2020; Seven and Abban, 2021). Synchronous courses are also recorded on the system and can be viewed asynchronously from the archive later on. Regarding these courses through the "Learning Management System",

course documents such as texts, video, presentation, audio, question bank, link activity, etc. can be uploaded and students can always access them, students can be assigned homework-project works and all kinds of exams (multiple choice, open ended, matching, sorting etc.) can be performed. Moreover, students can communicate and interact with each other and with the instructors with the tools such as e-mail, telegram, message box, forum, etc. depending on the applications hosted by the "Learning Management System".

With the global pandemic, distance education has been started in primary, secondary and higher education in our country as in all countries, and online learning platforms have been used in this process. In this context, with the decision taken by the Council of Higher Education (YÖK) in our country, compulsory distance education process has been started as of 23 March 2020 in universities and it has been decided that the spring semester will be continued with distance education, open education and digital education opportunities (YÖK, 2020; YÖK, 2020a). For the 2020-2021 academic year, YÖK took a new decision; *"it has paved the way for universities to plan their education calendars to start after 1 October 2020, and to make different applications on the basis of faculty and program by providing wide opportunities for universities to "dilute students on campuses and reduce mobility". At this point, the relevant committees of the universities were asked to decide on the applications to be made for different programs according to the regional and local course of the epidemic."* (YÖK, 2000b). After the start of pandemic process; *"72.6% of state universities and 60.6% of foundation universities switched to distance education, and as of 31 March-6 April 2021, 27.5% of state universities and 39.5% of foundation universities gradually started Ababan distance education completely. When the distance education practices of universities are examined, it is observed that more than 99% of both state and foundation universities carry the theoretical courses to distance education. The decision to teach the theoretical parts of the applied courses by distance education along with the theoretical courses has been approved by approximately 88% of the state and foundation universities"* (YÖK Uzaktan Öğretim Anketi, 2020).

In order to ensure learning in an online learning environment, there is a three-component interaction namely student, teacher and content (Garrison et al., 2020). According to the content of the courses conducted in online learning environments, many types of activities are interacted with. These are generally such activities as synchronous/asynchronous virtual classroom courses, course materials, assignments and projects, file sharing, in-system messaging, discussion forums, exams, etc. (Tuncer and Taşpınar, 2008). In this context, teaching is carried out through the interaction of students with each other and with the instructor of the course and teaching materials, synchronously or asynchronously (Aase, 2000). At this point, these interactions are very important in terms of reaching richer learning outcomes in order for online learning environments to be more effective and efficient (Garrison et al., 2020; Kılınç, 2022). The extent to which students find the learning activities offered to them meaningful in online learning environments, and the meaning and value they attribute to this process can also be determinative on the perceived advantages and disadvantages of the courses conducted with the transformed learning approach (Ay and Dağhan, 2022). The researches analyzing readiness, expectations and learning styles of students for online learning environments (Akyüz & Numanoğlu, 2020; Bakaç, 2022; Hacıcaferoğlu and Güner, 2021; Konak, 2021; Sakal, 2017; Sarıtaş and Barutçu, 2020; Şahin, 2022); attitudes, perception, motivation and stress (Abbasi et al., 2020; Aktaş et al., 2020; Ayhan, 2022; Bayındır, 2021; Coşkun and Çetin, 2022; Ergül, 2006; Etlioğlu and Tekin, 2020; İbicioğlu and Antalyalı, 2005; Oducado and Estoque, 2021; Özdirek and Cicerali, 2021; Yılmaz, 2020); self-regulation and self-efficacy (Baltacı et al., 2022; Çok, 2021; Özen & Karaca, 2021; Tuğtekin, 2022; Yıldız and Seferoğlu, 2020) and their experiences (Acar, 2022; Aral et al., 2022; Karaman et al., 2021; Tekedere et al., 2022) can be given as examples of these studies.

It is observed that the academic achievement of the students within the scope of online learning is mostly examined by associating them with the perspectives given above, and the relationship between direct online learning activities and the academic achievement of the students is examined in the research of Yavuzarslan and Erol (2022) on "using the learning management system log records in the estimation of academic success". In their work, Yavuzarslan and Erol (2022) applied some classification algorithms for the estimation of academic success on the log data obtained from the Moodle-based LMS, which 93 students enrolled in the 2020 Spring semester Basic Computer Applications course used for a period of 10 weeks. In the log files obtained, the number of logins, the number of viewing past topics, the total and average number of views, the total and average session duration, the number of downloading homework materials, the number of homework attempts, the time spent on homework, the exam focused study, the number of messages sent to the instructor, the time spent on video pages, and the number of homework uploaded were converted into attributes, and as a result, it was concluded that the LMS log records could be used in the estimation of academic success. In the sample of physical education and sports students, no research was found in this regard. As in face-to-face education, it can be determined by measurement and evaluation activities whether the expected goals in the courses are achieved or not in online learning environments (Phipps and Merisotis, 2000). This study aims to examine the relationship between the online

learning activities and academic achievements of Physical Education and Sports School students, and it is thought to contribute to the literature.

METHOD

This study, in which the relationship between some activities of the Physical Education and Sports School students in the online learning environment and their academic achievements was examined, was designed in the relational scanning model. Relational screening model is a research model that examines whether there is a relationship between two or more variables (Karasar, 2012). The research was conducted on the data of a total of 471 students who attended classes online in the 1st and 2nd year of a physical education and sports school of a state university in the spring term of the 2020-2021 academic year. Within the scope of the research, 444 students who participated in at least one of the activities of attending classes synchronously (live), asynchronously (from the archive) for 14 weeks, downloading course documents and watching videos uploaded about the course for 14 weeks through the "Learning Management System (LMS)" of the university were included. For the research, the necessary permission was obtained from the ethics committee of the relevant university with the decision dated 13.10.2021 and numbered 2021/9-7.

The raw data used in the research were obtained by two methods. In the first method, the duration of watching the courses live and from the archive (seconds), the number of downloading the course documents and the duration of watching the course videos uploaded (seconds) were downloaded from the system as an excel table within the scope of 14-week online learning activities of students via LMS. However, in the second method, the academic achievement scores obtained by calculating the students' midterm (30%) and final (70%) exam grades for these courses over the "Student Information System (SIS)" of the university were downloaded from the system and coded into an excel file together with their gender and class information. Then, the necessary controls were provided on the excel file and the data were transferred to the SPSS 22.0 program. In the research, students' academic achievement scores are the dependent variable and their gender, class, participation time in the online learning activities, live and archive attendance, number of downloading course documents and watching course videos are the independent variables. In the study, discontinuous (categorical) gender and class variables were coded as dummy variables and included in the analysis.

SPSS 22 program was used in the analysis of the data. In addition to descriptive statistical techniques, Pearson Product-Moment correlation and hierarchical regression analysis were used to determine the relationships between variables. Before proceeding to the regression analysis, it was first examined whether there were missing and extreme values and the necessary assumptions for the regression analysis were tested. At this stage, it was determined that there were no missing or extreme values, and that the skewness and kurtosis values of the data remained between (±2) and showed a normal distribution. However, the continuous variables of watching live courses and watching videos show a high correlation with each other, so the raw times for the relevant variables were subtracted from the mean of the relevant variable and then included in the analysis. As a result of the analysis, it has been determined that there is no multicollinearity problem found due to the autocorrelation (DurbinWatson (DW)=1.929) problem among the observations in the data set and the correlations between the independent variables being below .80. In addition, it has been observed that the tolerance value, which is the multiple linearity control tests, is greater than 0.2 and the VIF value is less than 10. In this direction, it has been observed that there is no multicollinearity problem between the dependent variable and the independent variables and the necessary assumptions for the regression analysis are provided (Pallant, 2007). The findings obtained were interpreted at $p<.001$, $p<.01$ and $p<.05$ levels.

FINDINGS

Table 1. Distribution of Descriptive Characteristics of Students

Characteristic	Category	n	%
Gender	Male	250	56.3
	Female	194	43.7
Online Courses	Scientific Research Methods	98	22.1
	Children and Sports	97	21.8
	Physical Education and Sports Education Programs	59	13.3
	Education Psychology	40	9.0
	Education Philosophy	43	9.7
	Public Administration	54	12.2
	Turkish Education History	53	11.9
Grade	1st Year	137	30.9
	2nd Year	307	69.1

Total	444	100.0

When Table 1 is examined, it has been observed that 250 (56.3%) of students are male and 194 (43.7%) are female. Of the students, 98 (22.1%) received Scientific Research Methods, 97 (21.8%) Children and Sports, 59 (13.3%) Physical Education and Sports Education Programs, 40 (9.0%) Educational Psychology, 43 (9.7%) Philosophy of Education, 54 (12.2%) Public Administration and 53 (11.9%) Turkish Education History course online. According to the grade level, 137 (30.9%) of the students are first-year students and 307 (69.1%) are second-year students.

Table 2. Descriptive Statistical Results of Academic Scores of Students (n=444)

	Aver.	**SD**	**Min.**	**Max**	**Skewness**	**Kurtosis**
Academic Achievement	63.95	16.12	0	99	-.936	1.890

When Table 2 is examined, it is seen that the achievement scores of the students who attend the online courses vary between 0 and 99 and the average academic achievement score is 63.95±16.12. It is observed that the skewness and kurtosis values of the students' academic achievement scores are between -2 and +2. According to this result, it can be said that the scores show a normal distribution (George and Mallery, 2010).

Table 3. The Relationship Between Online Class Attendance Activities and Academic Achievement Scores of Students

	AA	LCA	AAC	WCV	DCD	Gender	Grade
Academic Achievement (AA)	1						
Live Course Attendance (LCA)	.243**	1					
Archive Attendance of Course (AAC)	.105*	.006	1				
Watching Course Videos (WCV)	.142**	.725**	-.046	1			
Downloading Course Documents (DCD)	.105*	.315**	.119*	.312**	1		
Gender	.100*	.391**	.040	.213**	.259**	1	
Grade	.014	-.116*	.140**	-.141**	.061	-.011	1

*p<.05; **p<.01

It is observed in Table 3 that there is a positively moderate relationship between academic achievement scores of students and the duration of the live attendance in the course (r=.243; p<.01), and a positive relationship with duration of watching course videos from the archive (r=.105; p<.05), and with the duration of watching course videos (r=.142; p<.01) while there is a positive but low level correlation with the number of downloading course documents (r=.105; p<.05) and with their gender (r=.100; p<.05). The highest correlation between the independent variables was between the duration of watching the course videos and the duration of live attendance in the course (r=.725; p<.01). No significant relationship was found between students' academic achievement scores and their grade levels (r=.014; p>.05). In this sense, hierarchical regression analysis was conducted to determine to what extent the variables of Attending Course Live and from the Archive and Duration of Watching Course Videos, Number of Downloading Course Documents, which are among the online learning activities of students and gender predicted academic achievement scores. Analysis results are given in Table 4.

Table 4. Hierarchical Regression Analysis Results of Students' Online Course Attendance Activities and Gender on Predicting Academic Achievement Scores

Model		**R**	**R^2**	**ΔR^2**	**β**	**t**
1	Fixed	.243	.059	.057		86.054**
	Live Course Attendance				.243	5.278**
2	Fixed	.265	.070	.066		71.602**
	Live Course Attendance				.243	5.288**
	Archive Attendance of Course				.104	2.264*
3	Fixed	.268	.072	.066		59.824**
	Live Course Attendance				.288	4.310**
	Archive Attendance of Course				.101	2.190*
	Watching Course Videos				-.062	-.927
4	Fixed	.269	.072	.064		53.818**
	Live Course Attendance				.283	4.204**
	Archive Attendance of Course				.098	2.100*
	Watching Course Videos				-.067	-.988
	Downloading Course Documents				.025	.509
5	Fixed	.269	.073	.062		41.265**

Live Course Attendance	.287	4.015**
Archive Attendance of Course	.098	2.099*
Watching Course Videos	-.068	-1.000
Downloading Course Documents	.026	.529
Gender	.008	.166

Dependent Variable: Academic Achievement Score, *p<.05, **p<.001

According to Table 4 following the hierarchical regression analysis, first "live course attendance" (β=.243; t=5.275; p<.001) and then "live course attendance" (β=.243; t=5.288; p<.001) together with duration of "archive attendance of course" (β=.104; t=2.264; p<.05) statistically and significantly predict academic achievement scores of students. It is seen that other variables (watching course videos, downloading course documents and gender) included in the model in the 3rd, 4th and 5th steps did not significantly predict the academic achievement scores of the students. While the variable of "live course attendance", which contributed statistically to the model, alone explained 5.7% (ΔR2=.057) of the total variance, the additional contribution (0.9%) of the "archive attendance of course" variable included in the analysis in the second step was low. However, they increased the total variance in academic achievement scores to 6.6% (ΔR2=.066).

CONCLUSION

In this research, which analyzes the relationship between some activities in the online learning environment and the academic achievements of Physical Education and Sports School students, positive and significant relationships were found between the academic achievement scores of the students and the duration of watching the courses live, watching from the archive, watching the course videos, the number of downloading the course documents and the gender of students. No significant relationship was found between the academic achievement scores of the students and their grade levels. As a result of the hierarchical regression analysis organized regarding the extent to which the variables with significant relationships predict the academic achievement scores, it was concluded that first "live course attendance" and then, " live course attendance" and "archive attendance of course" significantly predicted the academic achievement scores of the students, but the level of prediction remained low. On the other hand, it was also established that the variables of watching the course videos, downloading course documents and gender did not significantly predict the academic achievement scores of students.

Since studies reveal the relationship between interaction data in online learning environments and students' academic performance (Cristobal et al., 2013, cited in Akçapınar et al., 2016), a positive relationship between students' activity level in online learning environments and their academic performance is an expected situation (Akçapınar et al., 2016). In this context, is seen in the literature that there are consistent results in the light of the findings obtained from the research. In the study of Akçapınar (2014) in which he tried to model the academic performance of students with the data mining approach according to the interaction data in the online learning environment, it has been concluded that students who are less active in the online learning environment exhibit low success in the course while students who are highly active exhibit high success in the course. There are also other studies that reached the same conclusion (Özbay and Ersoy, 2017; Whitmer et al., 2012; Yıldırım, 2018). As explained at the beginning, it is expected to achieve such results.

Research findings in which academic achievement in online learning is discussed from different perspectives are also in line with current research findings. In the research of Kurnaz and Ergün (2019) in which they examined the relationship between learning styles and academic achievement in e-learning environments, they have found that attending online classes, watching video recordings, active learning style and independent learning style predict academic achievement in the e-learning environment. In the current study, the duration of "live course attendance" and "archive attendance of course" significantly predicts the academic achievement scores of the students. It is stated in the study of Tuğtekin (2022) that while students' grade level and the time they spend in the online learning environment do not make a difference in their online self-regulation levels, they have an effect on their academic achievement and attendance in learning activities. In the study of Kaplan and Alkan (2022), in which the effects of distance education on student achievement during the global epidemic process are discussed with a qualitative approach, it is observed that student success is negatively affected by various reasons such as equipment problems, interest and attention problems, and situations such as teaching abstract subjects, following lessons and active participation are associated with failure in the distance education process. Güneş et al. (2017) have analyzed learner-content interactions by analyzing the enrollment logs of 426,211 students in mass distance education in the example of Anadolu University Open Education system, and concluded that learner-content interaction is an important variable in explaining academic achievement.

In the distance education process, many factors (cognitive, affective, technological infrastructure, psychological, etc.) can directly or indirectly affect the online learning performance of students or mediate their performance. As

a result, by considering some of the students' online learning activities and demographic characteristics, their relationship with their academic achievement grades was tried to be analyzed by quantitative method and a conclusion was reached in this research. Due to this limitation of the research, more in-depth results can be obtained by conducting new studies with a quantitative or qualitative approach with the control variables that may affect the academic achievement of students in online learning, according to different types of activities and interactions, or with the control variables that can affect academic achievement in online learning.

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Blockchain: A Content Analysis of Graduate Theses in Turkey

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Abstract
This study aims to make a descriptive analysis and evaluation of postgraduate theses on blockchain technology conducted in Turkey between 2017 and 2021. Qualitative research methods were used in this research, and theses were analysed with the descriptive content analysis technique. It has been observed that 111 studies have been carried out on blockchain technology and the first thesis was prepared in 2017. 107 graduate studies registered in the Higher Education Council of Turkey's National Thesis Centre database with access permissions were examined. Theses are coded according to publication date, university, institute, department, graduate/ doctorate level, advisors' academic title, thesis language, research method, research sub-areas, city and the region where the thesis was written. Studies on blockchain have been carried out in many universities, and Marmara University is the university that contributes the most to the subject with its graduate studies. Most studies were conducted at the Applied Sciences and Institute for Social Sciences. The distribution of the universities where the thesis studies are conducted according to the geographical regions is examined, the Marmara region leads with 70 studies, and no thesis studies have been carried out in the Eastern Anatolia region. Most of the thesis administrators are faculty members with the title of "Assist. Prof. Dr.". Most of the studies were written in Turkish, and primarily Qualitative Research methods were used. Theses were carried out in 10 institutes and 36 different departments, and most of the theses were produced from the studies in the Business department. The findings of this study will guide other researchers who want to work in the field of blockchain.
Keywords: Blockchain, Descriptive Content Analysis, Graduate Theses, Higher Education, Technology.

1. INTRODUCTION

Blockchain refers to the configuration of an add-only repository of transactions as a list of linked blocks distributed across many machines (Distributed Ledger Technology) (Rauchs et al., 2018). Each block contains a chronologically ordered set of transactions. Cryptographic hashes are used to secure the link from one block to the previous (Xu, Weber, & Staples, 2019). Understanding distributed architectures is a requirement for understanding the blockchain. In a distributed architecture, all stations are interconnected, and at the same time, all are data providers (Holbrook, 2020). Since all stations are servers simultaneously in distributed architectures, the system is more fault-tolerant and more flexible in expansion. Furthermore, since the control is not on specific servers, the most suitable architecture for the peer-to-peer exchange system, which eliminates the middleman, is the distributed architecture. While the distributed part of the Distributed Ledger technology comes from the distributed architecture, the ledger part is inspired by the ledger kept by the accountants, where the information about how much money was transferred between the entities and what the balance was. Each transaction is written on one line and processed according to the balance from the previous transaction. For this reason, if you want to change a transaction in between, you must change the balances of all transactions from that transaction onwards. This ledger is checked and registered periodically; hence, its modification is prevented.

Blockchain offers an architecture that models the distributed working of the ledger (Zheng, Xie, Dai, Chen, & Wang, 2017, June). Each page of transactions is a block, and when each page is completed, it is checked and registered. The rows in the ledger are modelled with the transactions in the blocks. All participants can access the blockchain, that is, the same ledger, and are allowed to validate and register new blocks with the programs they use. So all participants can create new pages in those blocks (Frizzo-Barker, Chow-White, Adams, Mentanko, Ha, & Green, 2020). Since there are many participants in this system, registration is provided by a consensus method. Bitcoin uses proof of work consensus. In this method, with the agreement of more than 50% of the participants, the block is registered and added to the chain. Different consensus methods have also been developed over time.

Another consensus method that should be mentioned is the proof of stake method. In this method, an amount of cryptocurrency is pledged. A certain number of controllers are appointed, taking into account the number of block transactions to be registered and the amount pledged, and upon their agreement, the block is registered.

In Blockchain structure, separate blocks form a chain by embedding the cryptographic summary of the previous block to be linked together like the pages of a ledger. A one-way function is used to obtain the cryptographic digest of the previous block. It converts the entered data into text of a specific size, regardless of the length or content of the data. Since it is one-way, the original content cannot be accessed from the translated text. For example, Bitcoin uses the SHA-256 cryptographic hash function. This function always produces a 256-bit cryptographic hash regardless of the length of initial data.

Szabo was the person who coined the term "Smart Contract" for the first time in 1994, which he defined as a "computerised transaction protocol fulfilling the terms of a contract" (Szabo, 1997). However, this idea, which found an application area with the spread of blockchain, has also been the element that carried the blockchain to the second stage (Swan, 2015). Smart contracts have all the features of blockchain. Smart contracts, like legal contracts, are signed between parties, but this signature is a cryptographic signature. In case of disagreement in legal contracts, a legal authority decides on a solution. In contrast, no other authority is needed in smart contracts because the rules written in computer code are automatically implemented in the blockchain environment. The prepared smart contract is added to a block on the blockchain platform. Therefore, smart contracts can be considered computer programs running on the blockchain. Smart contracts have found many uses, such as identity management and access control, real estate, internet of things (IoT), telecommunications, logistics, e-government/law, financial applications, health applications (Hewa, Ylianttila, & Liyanage, 2021), and education applications (Alammary, Alhazmi, Almasri, & Gillani, 2019; Tekgüç, Adalıer, & Yurtkan, 2020) are at the forefront of these areas.

Featured Blockchain based applications are classified as follows in the literature: Educational applications (Bedi, Gole, Dhiman, & Gupta, 2020; Tekgüç & Adalıer, 2021; Bdiwi, De Runz, Faiz, & Cherif, 2017; Spearpoint, 2017; Bore, Karumba, Mutahi, Darnell, Wayua, & Weldemariam, 2017, November), financial applications (Casino, Dasaklis, & Patsakis, 2019; Haferkorn & Quintana Diaz, 2014, December), business and industrial applications (Tapscott & Tapscott, 2017; Kshetri, 2018; Kogure, Kamakura, Shima, & Kubo, 2017), health management (Zhao, Zhang, Peng, & Xu, 2017, March; Mamoshina, et al., 2018), travel and tourism (Özgit & Adalıer, 2022; Calvaresi, Leis, Dubovitskaya, Schegg, & Schumacher, 2019), integrity verification (Bhowmik & Feng, 2017, August; Dupont, 2017), administrative management (Reijers, O'Brolcháin, & Haynes, 2016; Hou, 2017, July), internet of things (Adler, Berryhill, Veneris, Poulos, Veira, & Kastania, 2018, July; Lin, Shen, & Miao, 2017, July), privacy and security (Dorri, Steger, Kanhere, & Jurdak, 2017; Chanson, Bogner, Wortmann, & Fleisch, 2017, September), data management (Asharaf & Adarsh, 2017; Zhang, 2016).

Featured blockchain platforms are Bitcoin (Nakamoto, 2008), Ethereum (Buterin, 2020; Mohanty, 2018), EOS (EOS, 2021), Hyperledger Fabric (Hyperledger Fabric, 2021), Corda R3 (Corda R3, 2021), Ripple (Ripple, 2021), Quorum (Chase, 2021), and NEO (NEO, 2021).

This study aimed to investigate academic work at the graduate level that has been done on the Blockchain between 2017 and 2021 in Turkey. A total of 107 master's and doctoral theses were analysed, and the findings are presented in this paper. It provides descriptive information about the nature of the studies and offers recommendations for future studies on Blockchain.

2. METHOD

2.1 Design of the Study

This is a descriptive study that includes a systematic review of the research on Blockchain in Turkey. The data in this study were collected through document analysis, one of the qualitative research methods, and descriptive analyses of the reached theses were made. Document review includes analysing written materials containing information about the case or cases to be investigated. Descriptive analysis is a type of qualitative research. With descriptive analysis, data is collected with keywords determined using many data collection methods. The collected data is divided into specific themes and organised (Gökal, Cantemir, & Adalıer, (2021). The primary purpose of descriptive analysis is to make it an understandable and easy summary for the readers. The researcher reads, organises and digitises the data according to the previously created themes (Dawson, 2019).

2.2 Research Questions

This study addresses the following research questions:

1. How many theses have been written on Blockchain in the years 2017-2021 in Turkey?
2. How many theses have been written on Blockchain in various universities in Turkey?
3. How many theses have been written on Blockchain in various institutes in Turkey?
4. How many theses have been written on Blockchain in various departments of the universities in Turkey?
5. How many master's and doctorate degrees are there on Blockchain?
6. What are the academic titles of the supervisors who have supervised theses on Blockchain?
7. How many theses on Blockchain have been written in Turkish and English?
8. What are the research methodologies that researchers working on Blockchain followed?
9. How many sub-areas have been involved in research on Blockchain?
10. How many theses on Blockchain have been written in each city of Turkey?
11. How many theses on Blockchain have been written in each region of Turkey?

2.3 Population and Sampling

The population consists of theses and dissertations accessible from the YÖK (Higher Education Council of Turkey) National Thesis Centre database. The first dissertation on Blockchain was published in 2017. Therefore, the study's time frame was determined from 2017 to 2021 to include all published theses accessible from the centre on Blockchain. Purposive sampling was used as a sampling strategy. Of the 107 theses, 98 were master's theses, and 9 were doctoral dissertations.

The universe of this study is the YÖK National Thesis Centre database. The study sample consisted of masters and doctoral theses in the field of blockchain between the years 2017-2021. There was no thesis on this subject before 2017. Criteria for the determination of theses; Theses prepared between 2017-2021 that are registered in the YÖK National Thesis Centre database. These theses are the ones that can be accessed from the YÖK National Thesis Centre database. Theses within the scope of the research were collected in September 2021. The keywords "blokzinciri" and "blockchain" has been searched in the YÖK national thesis centre database. Thus, 111 theses registered to the National Thesis Center were reached within the scope of the research, of which only 107 are open to access.

2.4 Data Collection Procedure

During the data collection procedure, the keywords for the blockchain were entered in Turkish as "blokzinciri" and in English as "blockchain" in the search engine and were downloaded between 01 and 30 September 2021 by the researchers. 111 theses were located in the database, and 107 were open to access. Four theses out of the initially available 111 were eliminated from the study because their full texts were not accessible due to the access limits placed by their authors. The remaining 107 theses with access permission were included in the study. Out of 107 theses, 98 were masters' theses, and 9 were doctoral dissertations. Figure 1 shows the data collection procedure visually.

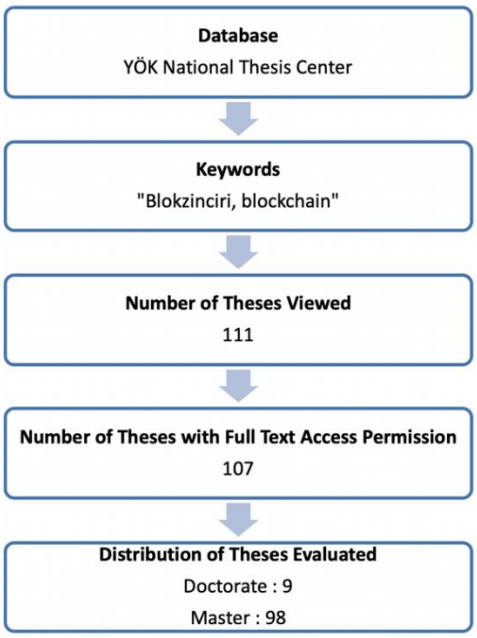

Figure 1. Data collection procedure

2.5 Data Analysis

Descriptive content analysis is used in this study. The theses were downloaded in PDF document format. The unit of analysis was identified as descriptive information regarding the nature of the graduate theses on Blockchain. Each thesis was assigned numbers starting from 1 to 107. The abstracts and full texts of 107 theses were read and analysed thoroughly. Eleven codes for the analysis were identified. The codes are as follows: the year, the university, the institute, the department, the graduate/doctorate level, the supervisors' academic title, language, research methodology, research sub-area, the city and the region where the thesis was written. Then, the frequency of each code was counted. The information on the frequency of the codes enabled the researchers to compare them.

3. FINDINGS

In this part of the study, the postgraduate theses on “blokzinciri” and “blockchain” between the years 2017-2021 were presented in figures according to the year, university, institute, department, graduate/doctorate level, supervisors' academic title, language, research methodology, research sub-area, city and the region where the study conducted.

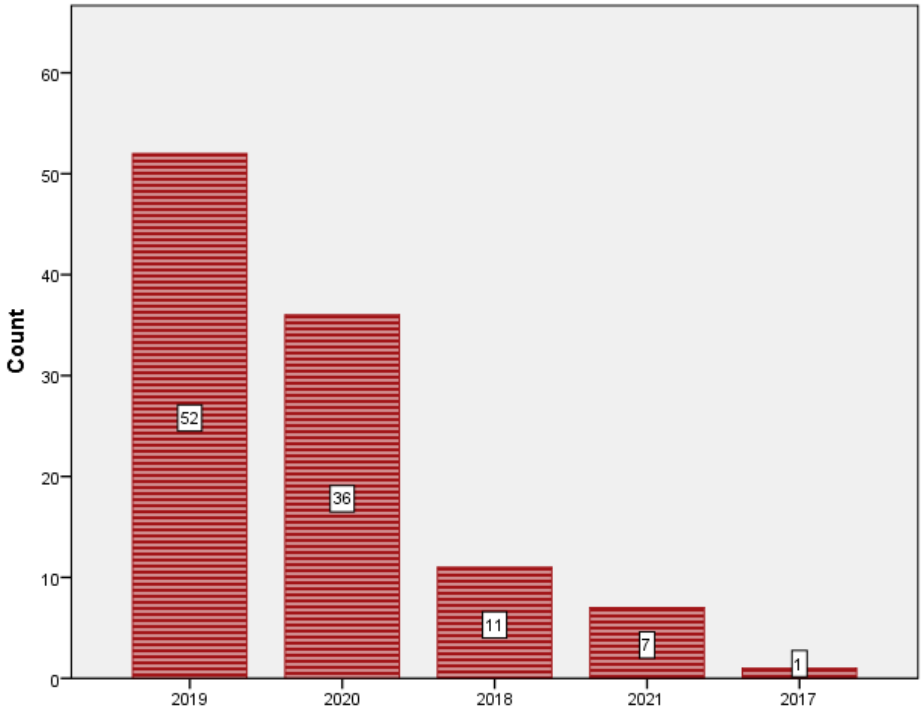

Figure 2. Graduate Theses According to Years

After the first and only study in 2017, blockchain studies on thesis subjects continued and became popular in the following years. The year with the most studies is 2019, with 52, which constituted 48.60% of the total studies, followed by 36 (33.64%) studies in 2020 and 11 (10.28%) studies in 2018. When Figure 2 is examined, there is a significant increase in the number of theses published since 2017, with the least number constituting 6.54% (7) of the total studies in 2021.

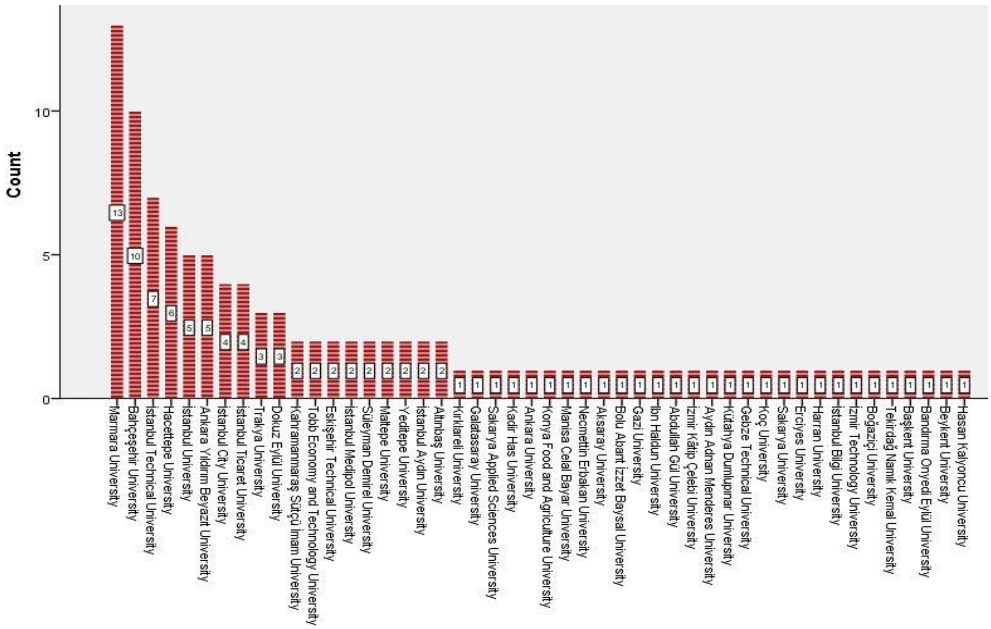

Figure 3. Graduate Theses According to Universities

As seen in Figure 3, A total of 107 thesis studies were carried out in 49 different universities. Marmara University is ranked as the university with the highest number of studies on the Blockchain, with 13 (12.15%). Bahçeşehir University followed with 10 (9.35%) studies, and Istanbul Technical University was in third place with seven thesis studies (6.54%).

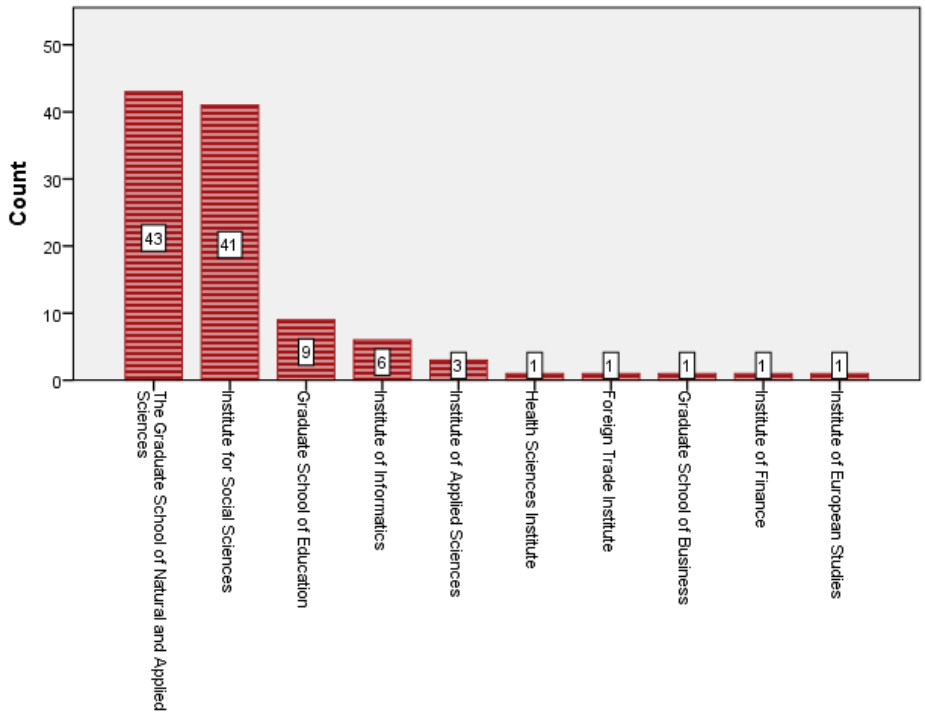

Figure 4. Graduate Theses According to Institutes

According to the distribution of institutes in Figure 4, studies were conducted under ten institutes. The Graduate School of Natural and Applied Sciences is where most studies are carried out, with 43 (40.19%). Following with 41 (38.32%) thesis studies, the Institute for Social Sciences carried out the second-highest number of studies. It has been observed that the Institute for Social Sciences and the Graduate School of Natural and Applied Sciences carried out almost the same number of studies. Then the Graduate School of Education with 9 (8.41%) theses, the Institute of Informatics with 6 (5.61%) theses, and the Institute of Applied Sciences with 3 (2.80%) theses. Health

Sciences Institute, Foreign Trade Institute, Graduate School of Business, Institute of Finance and Institute of European Studies each carried out 1 (0.93%) thesis.

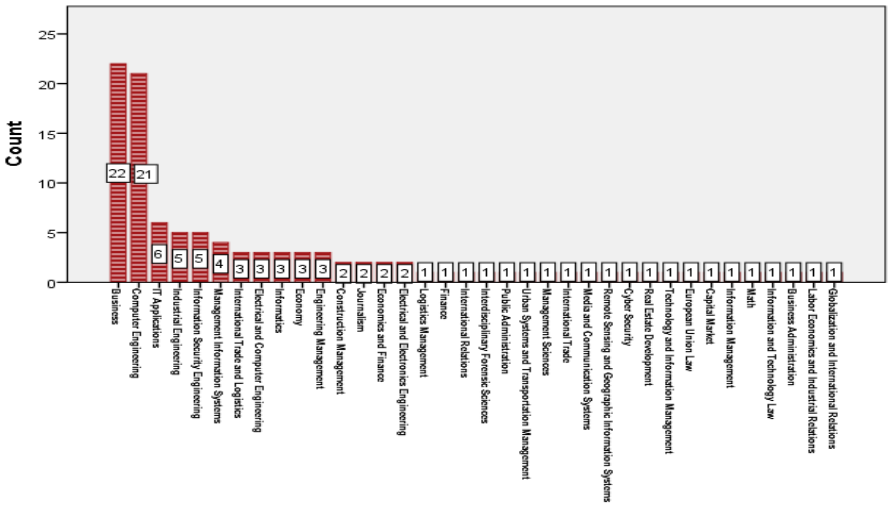

Figure 5. Graduate Theses Written According to Departments

Figure 5 shows graduate theses written about Blockchain in 36 different departments. The Department of Business has the most studies with 22 (20.56%) thesis. The Computer Engineering department follows with 21 (19.63%) studies as the department closest to the department of Business without any significant difference. Next follows IT Applications 6 (5.61%), Information Security and Industrial Engineering, each with 5 (4.67%), Management Information Systems 4 (3.74%), International Trade and Logistics, Electrical and Computer Engineering, Informatics, Economy and Engineering Management, each with 3 (2.80%). Four departments with two studies each, and 21 departments with only one study. As a result, we can say that a broad spectrum of disciplines and departments are interested in blockchain.

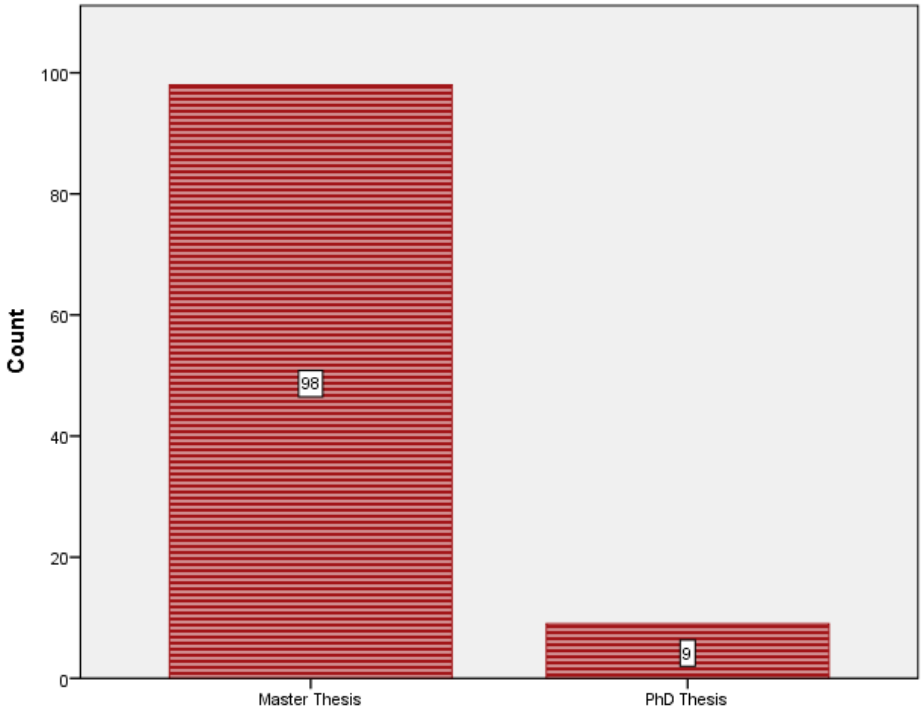

Figure 6. Graduate Theses According to Degree Levels

When Figure 6 is examined, it is seen that most master's theses were prepared with 98 (91,59%) studies consisting of master's theses. Master's theses were followed by doctoral studies with 9 (8.41%). The majority of the research was composed of master's theses.

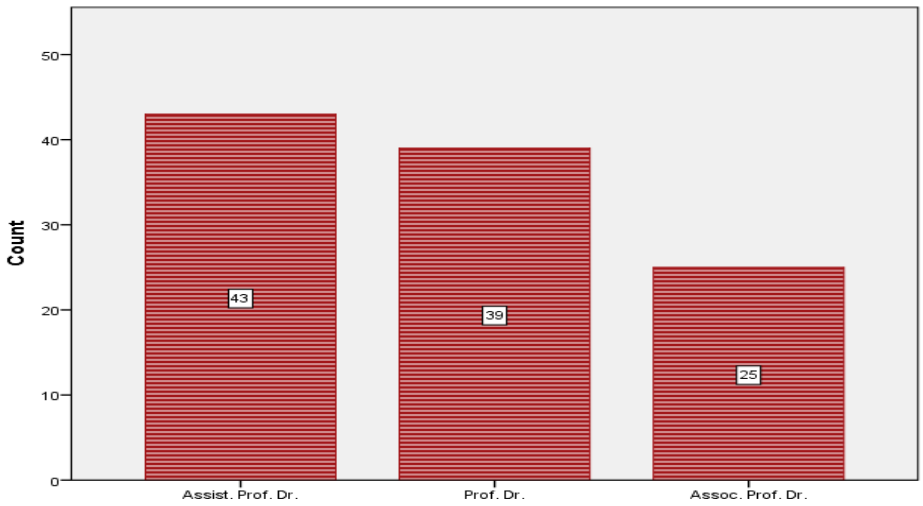

Figure 7. Graduate Theses According to Advisors' Academic Title

When Figure 7 is examined, it is seen that 43 (40.19%) studies were supervised by "Assist. Prof. Dr." followed by 39 (36.45%) thesis studies by "Prof. Dr." titled faculty members. For the following 25 (23.36%) theses, faculty members with the title "Assoc. Prof. Dr." supervised the thesis.

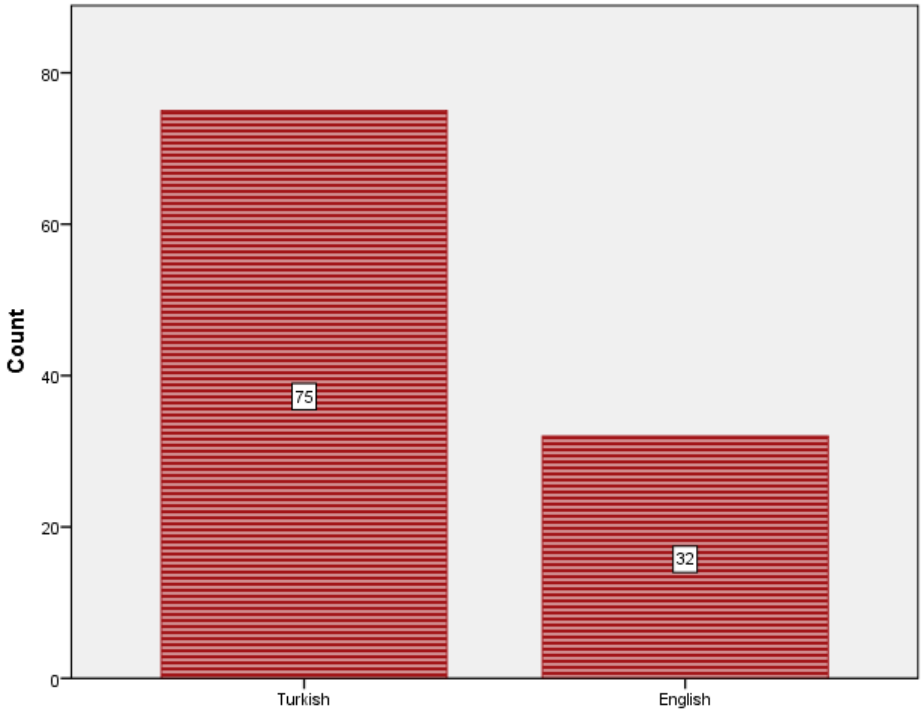

Figure 8. Graduate Theses According to Language

When Figure 8 is examined, it is seen that most of the theses were prepared in Turkish, with 75 (70.09%) thesis studies and 32 (29.91%) studies conducted in English. According to this result, although the thesis studies in Turkish seem more, there are also significant numbers of studies in English.

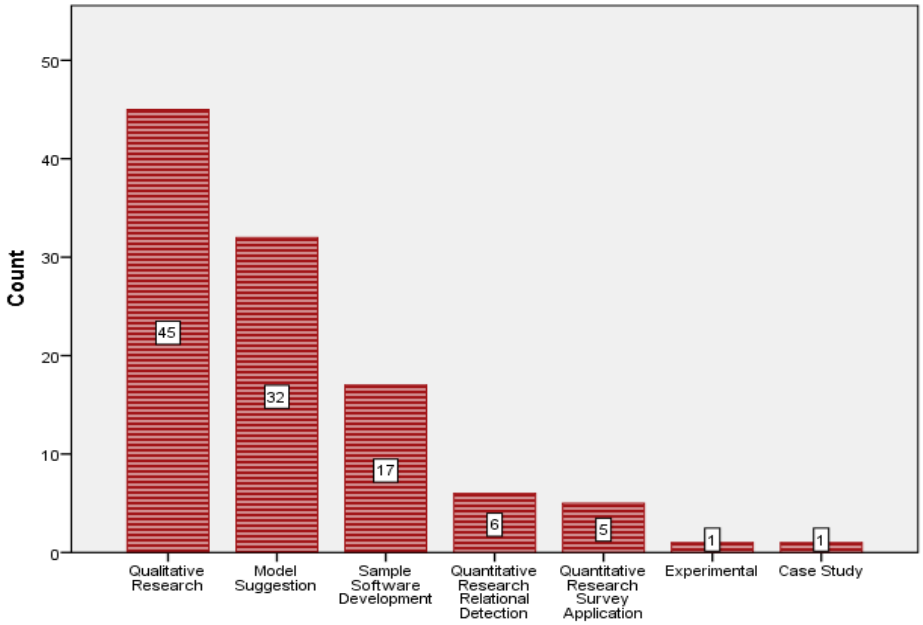

Figure 9. Graduate Theses According to Research Methodology

When compared by the research methodology, as seen in Figure 9, seven different methods were used in a total of 107 thesis studies. The qualitative research method constitutes 42.06% with 45 theses. 32 (29.91%) studies were carried out using the Model Suggestion method, 17 (15.89%) studies with Sample Software Development, 6 (5.61%) with Quantitative Research Relational Detection, 5 (4.67%) with Quantitative Research Survey Application, Experimental and Case Study methods were conducted only once (0.93%).

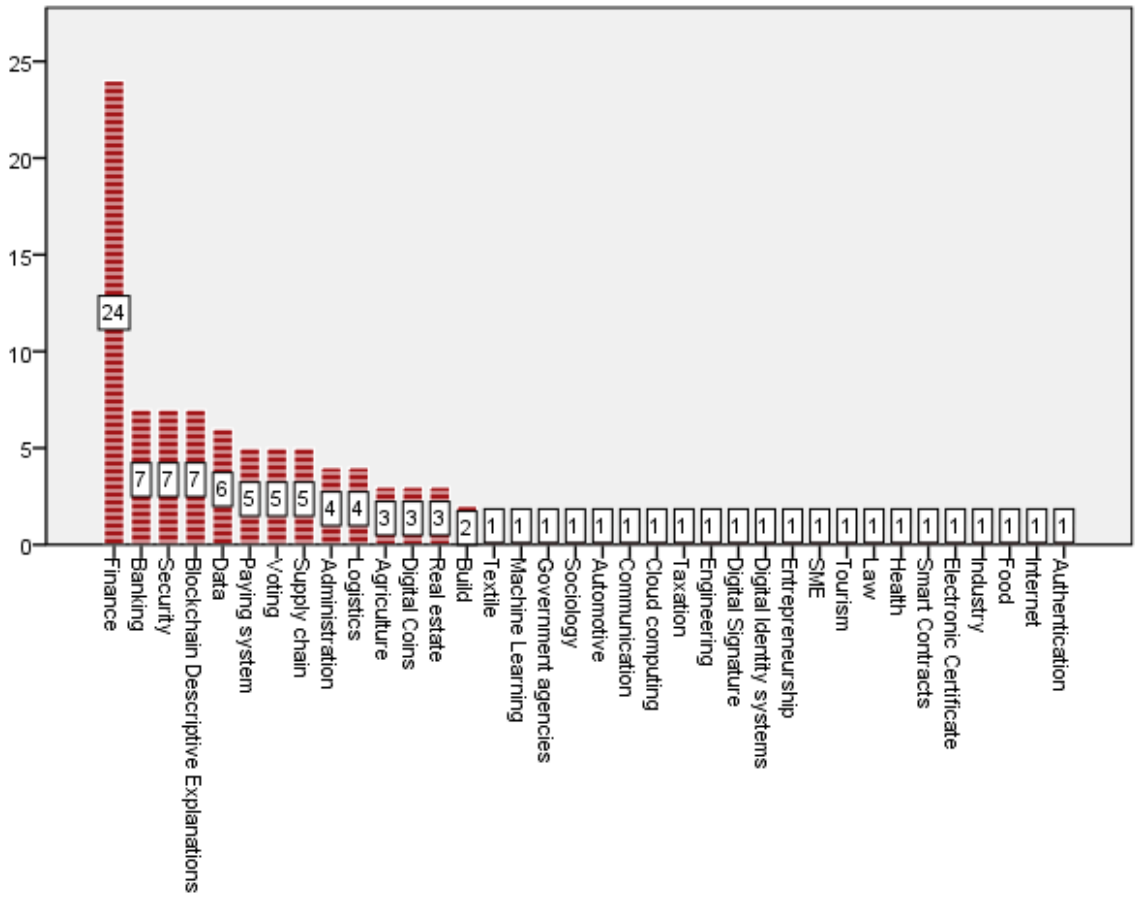

Figure 10. Graduate Theses According to Research Sub-area

Figure 10 shows areas of research in 36 different fields. As can be seen, most research was carried out in Finance, with 24 (22.43%) theses. The second place is shared between Banking, Security, and Blockchain Descriptive Explanations, with 7 (6.54%) thesis each. Six studies have been done in Data, with 22 fields contributing only 1 study each.

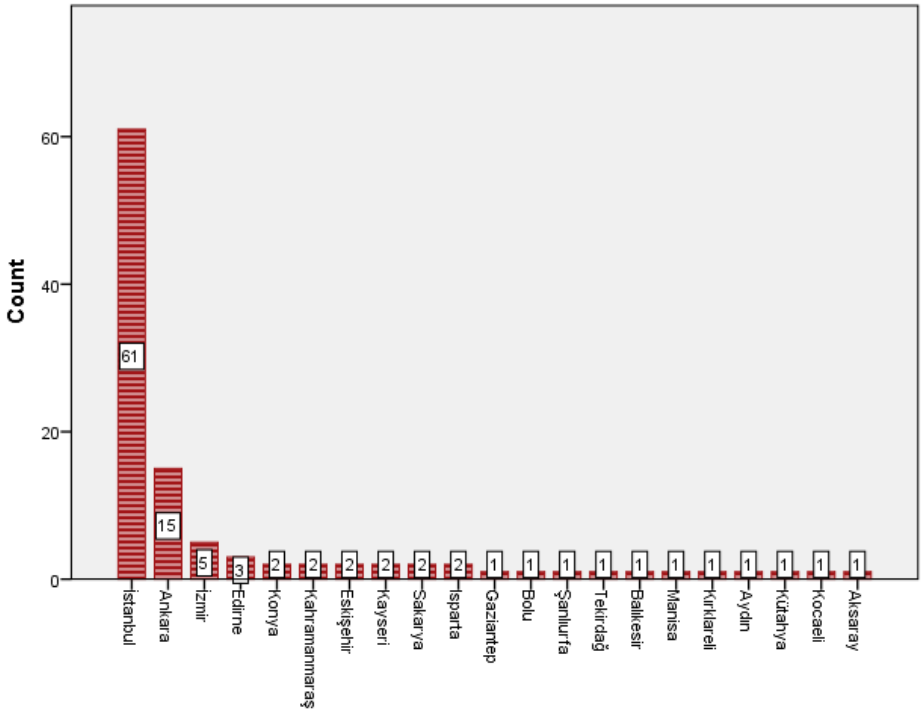

Figure 11. Graduate Theses According to Cities in Turkey

As can be seen in Figure 11, a total of 107 theses were carried out in 21 different cities. İstanbul covers more than half of all studies, with 61 (57.01%) according to the City where the research was conducted. Ankara follows with 15 (14.02%), then İzmir with 5 (4.67%), and Edirne with 3 (2.80%). Konya, Kahramanmaraş, Eskişehir, Kayseri, Sakarya and Isparta contributed with two each. The remaining 11 cities only contributed with one thesis each.

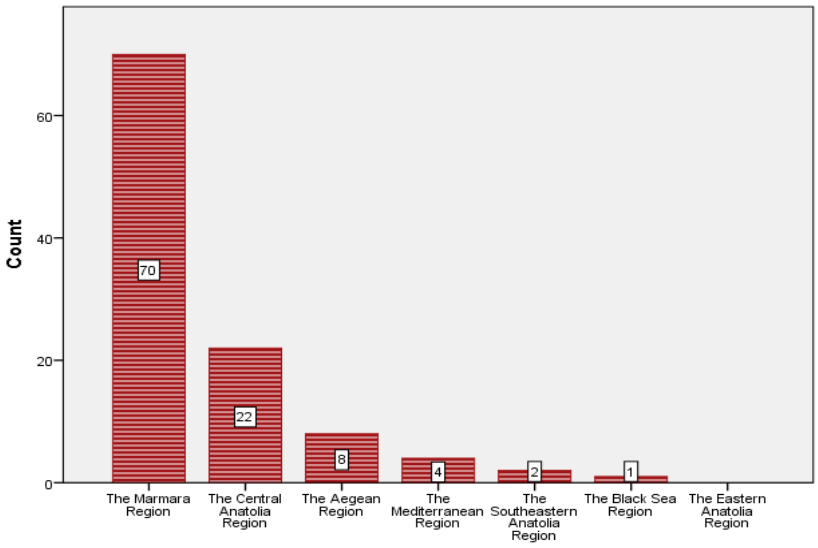

Figure 12. Graduate Theses According to Regions of Turkey

As can be seen in Figure 12, thesis studies were carried out in 6 out of 7 regions of Turkey. The Marmara region covers more than half of all thesis studies, with 70 (65.42%). The Central Anatolia region follows with 22

(20.56%). The Aegean region with 8 (7.48%), the Mediterranean region with 4 (3.74%), South East Anatolia region 2 (1.87%), Black Sea 1 (% 0.93) and no studies have been conducted in the Eastern Anatolia region.

4. DISCUSSION AND CONCLUSION

The popularity of blockchain studies as thesis subjects increased after the publication of the first and only study in 2017 in Turkey. There are 11 studies published in 2018, 52 in 2019 and 36 in 2020, and seven in 2021. A total of 107 thesis studies were carried out in 49 different universities. Marmara University is ranked as the university with the most (13) studies on Blockchain. Bahçeşehir University followed with ten, and Istanbul Technical University was in third place with seven thesis studies. Among all the universities, Istanbul universities take the lead with 61 thesis studies. Therefore, it is concluded that blockchain technology is a subject of more interest among researchers in Istanbul universities. Looking at the distribution of the studies among ten institutes, The Graduate School of Natural and Applied Sciences is where most (43) of the studies on the Blockchain are carried out. Following with 41, Institute for Social Sciences has the second highest number of studies, even though those two institutes are on opposite ends of the academic spectrum. Together, those two institutes created the majority of the studies. The Department of Business has the most studies with 22 theses. The Computer Engineering department follows with 21 studies and is the closest to the Department of Business. The remaining departments have studies below six each. According to the results, we can say that many disciplines and departments are interested in Blockchain, although the number of studies needs to be increased. The majority of the studies were Master's thesis, with 98.

On the other hand, doctoral thesis studies with only 9 followed Master's theses. It has been observed that there is a significant gap in the number of doctoral dissertations and Master's thesis studies; hence PhD students can be encouraged to study Blockchain-related research more. According to the titles of thesis advisors, 43 studies were supervised by “Assist. Prof. Dr.” and 39 thesis studies by “Prof. Dr.” titled faculty members. Almost two-thirds of the studies are written in Turkish, totalling 75. On the other hand, 32 studies were conducted in English. According to this result, the thesis studies are mainly in Turkish. Therefore, more studies in English must be encouraged. Concerning the research model, seven different methods were used in a total of 107 thesis studies. The Qualitative Research method leads with the 45 studies. While 32 studies were carried out using the Model Suggestion method, 17 studies in Sample Software Development, 6 Quantitative Research Relational Detection, 5 Quantitative Research Survey Application, and Experimental and Case Study methods were conducted only once. All thesis span 36 fields of research, with most research carried out in finance with 24 theses. The second place is shared between banking, security, and blockchain descriptive explanations with seven theses each. Six studies have been done in Data, with 22 fields contributing only 1 study each. When these fields are compared with the recent featured blockchain-based applications mentioned in the literature, it is seen that more studies need to be done in these fields. Also, it has been seen that there is no study in the education field. Blockchain has potential in the field of education, and there are many kinds of research opportunities in the areas of scalability, privacy and security, cost, trust, setting boundaries, immutability, immaturity, lack of sufficient data and weakening the traditional school concept, which are the challenges to be overcome in practice.

Thesis studies were carried out in 21 cities, İstanbul dominating with 61 alone. Ankara follows with 15, İzmir 5, and Edirne with 3. The remaining 11 cities only contributed one thesis each. The number of studies must be increased in those cities. According to the geographical regions, thesis studies were carried out in 6 out of 7 regions of Turkey. The Marmara region covers more than half of all thesis studies, with 70. The Central Anatolia region follows with 22, then the Aegean region with eight, the Mediterranean region with 4, South East Anatolia region with two and the Black Sea region with only one. The Eastern Anatolia region has not contributed at all. Therefore, it is concluded that Western regions are more interested in Blockchain, and Eastern regions can be involved with the topic more.

Future research can concentrate on the studies published in internationally indexed journals. Comparisons concerning the methodology, field of studies, and contributions might be analysed. Postgraduate students can be encouraged to review Blockchain studies in different countries and write comparative studies. Such studies can contribute to both practitioners and decision-makers. Moreover, the research scope can be expanded by examining the articles on the subject at the national and international levels. More studies can be written jointly by various disciplines. Doctoral dissertations about Blockchain technology must be encouraged. The English language used for blockchain thesis research can be promoted more. Blockchain, which has started to be used in many areas worldwide, attracts attention and finds an increasing place of usage. The new developments in the world have led all companies and countries to concentrate more on blockchain technology as the main driving force of the developments and to achieve competitive advantage. For this reason, it is crucial to increase the number of postgraduate studies in Turkey by diversifying research topics in the fields such as tourism, transportation, higher education, and service industries is necessary.

4.1 Limitations

This study is limited to postgraduate studies, which could be accessed with full-text permission from the YÖK national thesis centre database that was written between 2017-2021, and has one of the keywords "blokzinciri" and "blockchain". Thus, the results of this study are generalisable within the context of Turkey.

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Do SPOC Really Improve Student Learning in Vocational Schools? A Meta-Analysis of Studies in Chinese Contexts

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ABSTRACT
Published studies on SPOC provided inconsistent findings regarding its effectiveness. Adopting a meta-analysis method, this study combined the results of 32 experimental and quasi-experimental studies published in the past 8 years in China for analyzing the overall effect size of SPOC for improving student learning in vocational schools. Data analysis confirmed that SPOC has a moderate positive effect, with a combined effect size of 0.592 ($P<0.05$). Further analysis revealed three significant factors that moderate the effect of SPOC, including discipline area, group size, and knowledge type. SPOC has a larger effect size for disciplines of engineering technology and medical education than of natural science, and humanities and social science. Integrating SPOC for a small to medium-sized group with no more than 50 students brings about significant improvement in learning outcomes. Compared to declarative knowledge, SPOC is effective for developing procedural knowledge. The findings support the adoption of SPOC in vocational education. To amplify its impacts, multiple factors need to be carefully considered in the design and implementation.
KEYWORDS: Small private online course (SPOC), blended learning, meta-analysis, learning effectiveness, vocational education.

1. INTRODUCTION

1.1 Small-scale private online course (SPOC)

Small-scale private online course (SPOC) is a blended instructional model that applies massive online open course (MOOC) resources (e.g., videos, tests, discussion forums) to small-scale instructional scenarios (Fox, 2013; Fox, Patterson, & Walcott-justice, 2013). SPOC is small in scale as it involves a limited number of students in a single school or even a single class, and is private as its admission is restrictive and often requires registration and tuition fees (Freitas, & Paredes, 2018). SPOC harnesses the potentials of MOOC and accommodates its perceived problems such as difficulty in credit certification, high attrition rate, and superficial interaction (Kaplan, & Haenlein, 2016). SPOC translates established MOOCs into customized, niche-based online open courses to complement traditional instruction through blended learning approaches such as the flipped classrooms (Ramírez-Donoso, et al., 2021). It combines student-centered methods and resources with the conventional classroom-based instruction (Bansal, & Singh, 2015). The goal of SPOC research is to achieve organic integration of MOOC and classroom-based instruction to support and improve knowledge and skill development (Baggaley, 2014). Effective SPOC will provide a proved model for blended learning (Reininga, et al., 2015).

1.2 Related studies of SPOC

With the advent of the information age, innovative instructional models emerge, and traditional offline courses and online instruction are being integrated and blended. In SPOC, online interaction and on-site, offline instruction complement each other, conducive to in-depth learning and communication (Hadad, Shamir-Inbal, Blau, & Leykin, 2021). Many researchers of SPOC advocate its positive impact on educational practices. According to Loehr, et al. (2013), the integration of SPOC into software engineering courses significantly improved student learning efficiency. Jong (2016) also confirmed the positive role of SPOC for improved learning outcomes. Compared to MOOC, SPOC features teacher guidance, which was identified as the key contributing factor to such improvement. The privateness, another distinguishing feature of SPOC from MOOC, also facilitates learning. To access SPOC, formal registration is usually required; there is often a competitive application process and a tuition fee charged (Kaplan, & Haenlein, 2016); and the learning objectives and contents are personalized. These mechanisms all enhance student motivation for and participation in learning (Lockhart, et al., 2017).

From the perspective of teaching, SPOC is also impactful. Hadad, Shamir-Inbal, Blau, & Leykin (2021) acknowledged SPOC as an innovative approach to teacher professional development, curriculum construction, and discipline development. SPOC promoted the construction of international, online platform-based courses of good quality at a low cost. Leveraging these transnational tools and resources, teachers could keep in line with innovative, effective concepts and methods of instruction, construct, benchmark and improve curriculum, and further develop the discipline (Meriem, & Youssef, 2020). With SPOC, teachers could develop an international

vision and enhance competitiveness, so could the curriculum, the discipline, and even the institution.

On the contrary, some researchers still hold a reserved view about the effectiveness of SPOC for augmenting learning. In Larson & Yamamoto (2013), there was no significant difference in learning outcomes between the SPOC experimental group and the control group who participated in traditional, lecture-based instruction in a computer technology course. SPOC will only be effective when the following is achieved: 1) tailored design based on learner attributes (e.g., age and cognitive style); 2) clear navigation and detailed annotation of learning resources; 3) real name registration and real-time monitoring; 4) visualization of learning process and progress; 5) responsiveness in discussion and interaction; and 6) proper evaluation and assessment (Müller, & Mildenberger, 2021; Björkdahl, Nyberg, Runeson, & Omérov, 2011). Meanwhile, credit certification and accumulation system of SPOC should be established and improved (Vallée, A., Blacher, J., Cariou, & Sorbets, 2020).

Overall, existing studies of SPOC provided inconsistent evidence about the effectiveness. And constraints such as a small sample size and low external validity that present in most published studies further impeded the reliability and generalizability of their conclusions. Meanwhile, the factors that influence the effect of SPOC need to be further investigated.

2. RESEARCH PURPOSE AND QUESTIONS

This study employed the meta-analysis method to systematically quantify the effect of SPOC for improving learning in vocational schools in China as reported in published experimental and quasi-experimental studies, and explore the factors that influence the effect of SPOC. The findings will inform future practices of SPOC for better outcomes of vocational education.

3. METHODOLOGY

3.1 Meta-analysis

Meta-analysis is widely used in educational technology research. Meta-analysis is a statistical analysis method that combines the results of multiple experimental or quasi-experimental studies to calculate the effect size of an intervention (Cooper, Hedges, & Valentine, 2019; Lipsey, & Wilson, 2000). The effect size (ES), i.e., the standardized mean difference (SMD) between the experimental group and the control group, could be calculated using formula (1).

$$ES = \frac{\bar{Y}^{T} - Y^{C}}{S} \qquad (1)$$

In this formula, $\bar{Y}^{T}$ represents the mean value of the experimental group (SPOC group); Y^{C} represents the mean value of the control group (conventional instruction group); and S represents the standard deviation between the experimental group and the control group.

$$= \frac{\qquad}{\qquad} \qquad (2)$$

For the total population, the effect size of SPOC could be calculated by formula (2). In this second formula,

is the mean value of population who experienced SPOC; is the mean value of the population without that experience; and is the standard deviation between these two population.

To address the issue of heterogeneity among studies, i.e., the studies included differed in sample and intervention, two solutions have been developed. One is to use dummy variables to represent factors that introduce heterogeneity, and the other is to use a random effects model or fixed effects model in analysis. If sample heterogeneity is significant, the second solution should be applied. Based on the data for this meta-analysis, we used the random effects model. To eliminate the influence of heterogeneity, weighted least squares (WLS), where the reciprocal of standard deviation is used as the weight, was employed. In this study, Standardized Mean Difference (SMD) was used as the effect value to evaluate the impact of SPOC blended learning on students' learning performance，applying formula (3).

$$SMD = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{\frac{(n_1 - 1)s_1^{2} + (n_2 - 1)s_2^{2}}{(n_1 + n_2 - 2)}}} \qquad (3)$$

In this formula, n_1 and n_2 represent the sample size of the experimental group and the control group respectively; $\bar{X}_1$ and $\bar{X}_2$ represent the mean value of the experimental group and the control group respectively, and s_1 and s_2 represent the standard deviation of the experiment group and control group respectively.

3.2 Literature search and selection

3.2.1 Literature retrieval

This meta-analysis focused on the effectiveness of SPOC for improving vocational education in China. The databases for identifying the target literature were the most influential academic platforms in China, including the China National Knowledge Infrastructure (CNKI), Wanfang database, and VIP database (Li, & Wang, 2022). The search keywords included SPOC, online course platform, blended teaching, blended learning, empirical research, applied practice, practical research, and applied research. To reflect recent, influential investigations on the topic, studies published before the year of 2014 and are not indexed in CSSCI journals or the core journals of Peking University were excluded. Duplicates were removed. At this literature retrieval stage, a total of 689 studies were collected.

3.2.2 Literature selection process and criteria

The 651 studies were exported for further screening and selection according to the following criteria: 1) the study should focus on the effectiveness of SPOC on student learning; 2) the study should be an empirical investigation; 3) the study should adopt an experimental or quasi-experimental method with a SPOC experimental group and a control group of conventional instruction and with a pre-test and post-test design; and 4) the study should provide all the necessary information and statistics including the sample size, mean, standard deviation, and effect value. Four iterative cycles of screening were conducted, and resulted in a total of 32 studies for the final analysis, which met the criteria that the minimum number of studies required for a meta-analysis (Rienties, & Toetenel, 2016). All the studies were independent of each other. The selected studies adopted the Cohens'd, Hedges' G, or SMD to measure the effect size of the intervention, Thus, the total number of effect size of the studies retrieved was 32. In total, 1,825 students participated in SPOC as the experimental group, while 1,823 received conventional as the control group. The process of literature screening is shown in Figure 1.

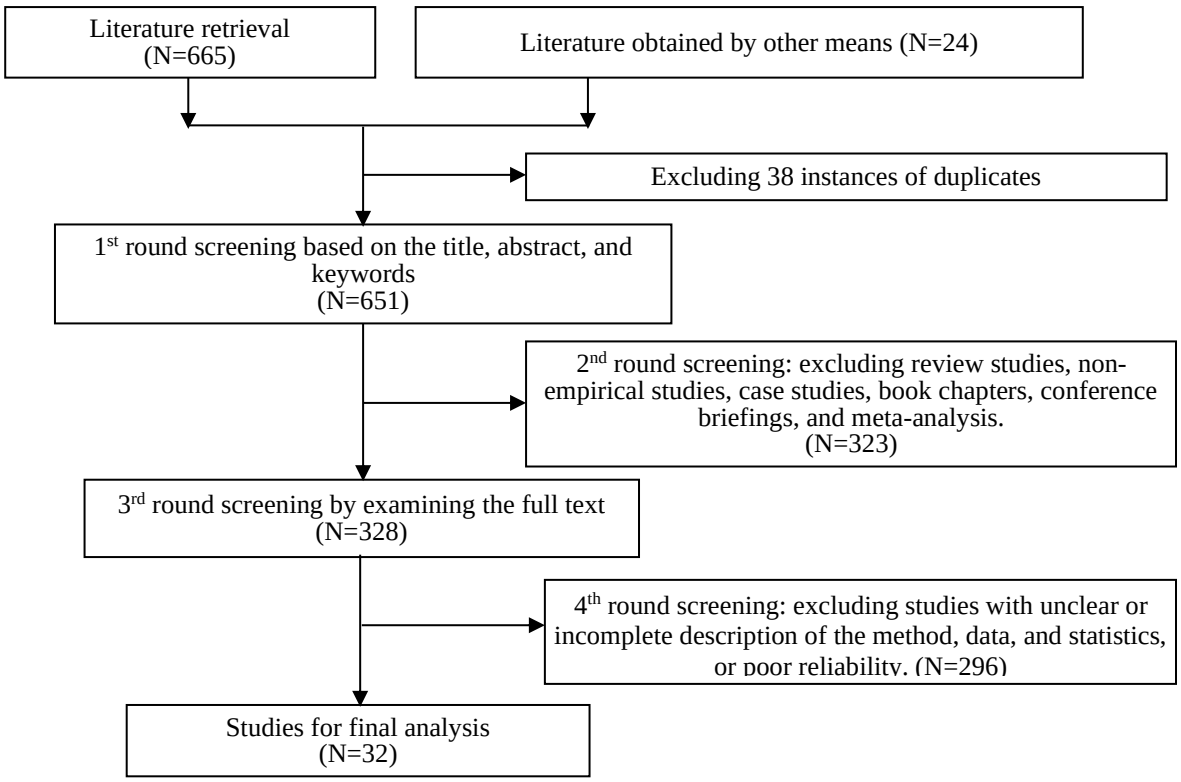

Figure 1: Literature screening process

3.3 Coding

In the following, the 32 studies were coded and categorized using the Microsoft 2019 Excel spreadsheet. Of each study, the author, year of publication, group size, length of intervention, discipline area, and knowledge type were

annotated (Table 1). Learning effectiveness was proposed as the dependent variable, SPOC the independent variable, and group size, discipline area, knowledge type the moderating variables.

Table 1: Meta-analysis literature information for statistical purposes

No.	Author (Year)	No. of students		Discipline area	Group size	Length of intervention	Knowledge type
		E	C				
1	Yin, H. D. (2016)	39	30	2	2	2	1
2	Fu, X. H. (2017)	49	49	4	2	1	2
3	Feng, R. (2015)	50	49	4	2	3	1
4	Xia, Z. (2015)	46	42	2	2	2	2
5	Wang, X. L. (2017)	100	104	4	3	2	2
6	Zha, C. Y. (2019)	24	26	2	1	1	2
7	Chen,Y. (2021)	160	160	4	3	2	1
8	Zha, J. (2016)	90	86	2	3	3	2
9	Wang, L. (2021)	44	47	4	2	2	2
10	Wang, Y. (2019)	69	62	2	3	2	2
11	Chen, L. (2017)	51	51	4	3	2	1
12	Hu, S. Z. (2019)	29	30	4	1	1	1
13	Gao, W. (2017)	51	53	4	2	2	2
14	Tan, J. X. (2016)	50	54	2	2	2	2
15	Hu. H. (2022)	41	42	1	2	2	1
16	Ding, J. (2022)	24	26	3	1	2	1
17	Wu, Y. H. (2022)	35	35	2	2	2	2
18	Li, Y. (2022)	30	32	2	2	3	2
19	Xu, J. (2021)	34	34	2	2	2	2
20	Yang, Q. (2022)	40	40	2	2	2	2
21	Chen, L. (2020)	30	30	2	1	2	1
22	Shi, T. H. (2020)	30	30	2	1	2	2
23	Wang, W. X. (2018)	79	84	3	3	3	1
24	Yu, Y. (2020)	23	22	4	1	2	2
25	Shen, Y. (2019)	102	104	4	3	2	1
26	Shi, Y. L. (2018)	88	89	1	3	2	2
27	Ren, J. (2017)	96	96	3	3	3	1
28	Wang, J. J. (2018)	67	65	3	3	2	1
29	Chen, S. Y. (2017)	85	85	2	3	2	2
30	Xie, H. L. (2017)	113	111	2	3	2	2
31	Ming ShanTseng (2017)	30	30	3	1	2	1
32	Meng-Hsiun Tsai (2017)	26	15	3	1	2	1

Please refer to Table 1 for a summary of the coding scheme. The group size was categorized as 1) small, 2) medium, or 3) large. If the number of students in the experiment/control group was smaller than 30, the relevant study would be coded as having a small group size; if the number was between 30 and 50, the study would be coded as having a medium group size; if the number was larger than 50, the study would be coded as having a large group size. The discipline area involved in the studies was categorized as 1) natural science (including mathematics and statistics), 2) humanities and social science (including English, marketing, and human resources management), 3) engineering technology (including architectural technology and computer technology), or 4) medical education (clinical education and nursing education). The length of the intervention was categorized as 1) short (within 2 months), 2) medium (2-4 months); or 3) long (more than 4 months). Knowledge type was coded as 1)procedural knowledge, or 2) declarative knowledge. For a full list of the 32 studies and a summary of the coding results, please refer to Table 2.

Table 2: Coding dimensions and coding items

Dimension	Coding items
Group size	1. Small: 30 students per group 2. Medium: 30-50 students per group 3. Large: more than 50 students per group
Length of intervention	1. Short: within 2 months 2. Medium: 2-4 months 3. Long: more than 4 months
Discipline area	1. Natural science: mathematics and statistics 2. Humanities and social science: English, marketing, and human resources management 3. Engineering technology: architectural technology and computer technology 4. Medical education: clinical education and nursing education
Knowledge type	1. procedural knowledge 2. declarative knowledge

3.4 Data Analysis

Comprehensive Meta-Analysis (CMA3.0) was adopted to analyze data. CMA 3.0 is powerful for data integration and statistical analysis of effect size of multiple sets of data (Park, & Suh, 2021). In this study, the sample size, mean values, and standard deviation of each study collected was put into CMA3.0， All data were put into CMA 3.0 for analysis， Data processing in CMA has the following four steps. 1) The publication bias test is conducted to determine whether there is serious publication bias according to the publication bias funnel plot or Begg's rank (Pierce, 2008). If there is no publication bias, the second step is conducted. 2) According to value of I-square, make heterogeneity test and choose the random effects model or the fixed effects model. 3) The overall effect value determines whether SPOC blended learning has a significant effect on learning outcomes. 4) Conduct moderating variable analysis to determine whether there are significant differences among the moderating variables, that is, whether they have a positive impact on SPOC blended learning (Mavi, & Erbay, 2021).

4. RESULTS

4.1 Publication bias test

Publication bias occurs when the selected literature is not systematically representative of the overall body of research in the field (Torgerson, 2006). Publication bias may seriously compromise the validity of a meta-analysis. In this study, the funnel plot of effect value distribution and Begg's rank correlation test were used to measure whether our selection of published studies was biased or not. In the funnel plot derived (Figure 2), the 32 studies were evenly distributed on both sides of the spindle, indicating an absence of significant publication bias. The Begg's rank correlation test result further confirmed this observation. The publication bias value was not significant ($Z=1.297<1.96$, $P=0.195>0.05$). Integrating the funnel plot and Begg's test, we affirmed the representativeness of the selected studies of the research field investigated.

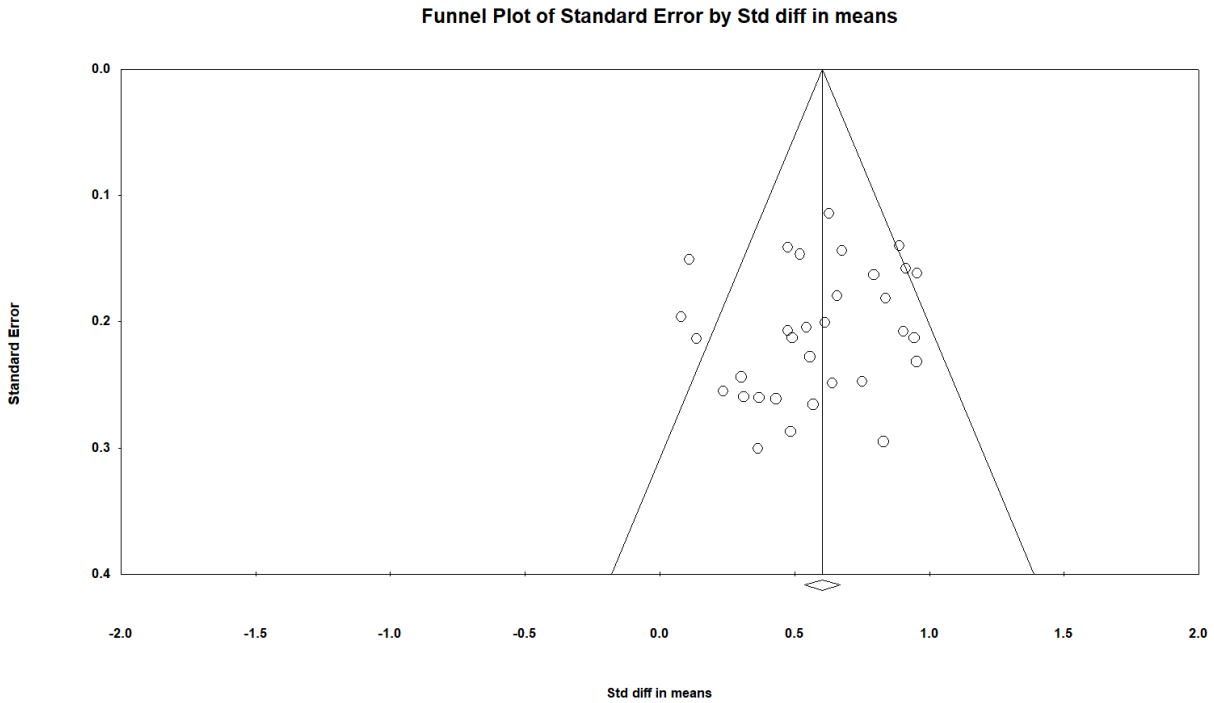

Figure 2: Funnel plot result

4.2 Heterogeneity test

Table 3 displays the results of the heterogeneity test. I-squared value represents heterogeneity. When the value is between 0 and 100, the greater the value, the greater the heterogeneity (Forsberg, Martinussen, & Flaten, 2017). In this study, the I-squared value was 82.153, indicating a high degree of heterogeneity among the studies selected. The heterogeneity reflected differences in sample and intervention. In meta-analysis research, the common practice is to use the fixed effects model for analysis if the heterogeneity value is small, and to use the random effects model when the heterogeneity value is large (Borenstein et al., 2021). Therefore, the random effects model was adopted in this study.

1: Heterogeneity test results and the random effects

Model	No. of Studies	ES (SMD)	S.E.	95% CI		Test of null (2-Tail)		Heterogeneity			
				Lower limit	Upper limit	Z-value	P-value	Q-value	df (Q)	P-value	I-squared
Fixed	32.000	0.602	0.033	0.536	0.6681	17.836	0.000	123.613	31	0.004	82.153
Random effects	**32.000**	**0.592**	**0.047**	**0.500**	**0.684**	**12.647**	**0.000**				

4.3 The effectiveness of SPOC

The random effects shown in Table 3 revealed that the combined effect size (SMD) of SPOC for vocational education in the Chinese context was 0.592. The Z score was 12.647 (P<0.001), indicating a significant difference between the SPOC experimental group and the control group. According to Cohen (2013), an effect value less than 0.2 indicates poor effectiveness; an effect value indicates minor effectiveness; an effect value between 0.5 and 0.8 indicates moderate effectiveness; and an effect value equal to or greater than 0.8 indicates large effectiveness (Cohen, 2013). The result of this meta-analysis showed that SPOC has a moderate positive impact on student learning in vocational schools.

4.4 The influence of moderating factors

4.4.1 The influence of discipline area

In this meta-analysis, the discipline area that SPOC was applied to each study was categorized. How did SPOC impact the learning of different discipline areas was analyzed and the results are presented in Table 4. The effect size of SPOC for the learning of natural science, humanities and social science, engineering technology and medical education was 0.426 (P=0.012<0.05), 0.231(P=0.023<0.05), 0.801(P=0.005<0.05) and 0.712(P=0.009<0.05) respectively, indicating a positive effect of the intervention across discipline areas. The inter-group difference was also significant (Chi2=8.426, P=0.038 <0.05), suggesting discipline area being a moderate factor for the effectiveness of SPOC. When integrated into engineering technology and medical education, SPOC

better facilitated student learning and brought about improved outcomes. This might be explained by the extra time for practice enabled by SPOC. With SPOC, much of the learning content was viewed online outside of the classroom, so the classroom-based instruction could be more focused on practice and application, which is crucial for a skill-based discipline.

Table 2: The effectiveness of SPOC for different discipline areas

Discipline area	No. of Studies	ES (SMD)	S.E.	95% CI		Test of null (2-Tail)		Inter-group effect size
				Lower limit	Upper limit	Z-value	P-value	
1. natural science	3	0.426	0.055	0.376	0.744	7.624	0.012	Chi^2=8.426 P=0.038
2. humanities and social science	14	0.231	0.044	0.295	0.453	5.189	0.023	
3. engineering technology	5	0.801	0.072	0.476	1.095	11.094	0.005	
4. medical education	10	0.712	0.091	0.384	0.935	7.811	0.009	

4.4.2 The influence of group size

The second factor that might regulate the effect of SPOC was the group size. Whether SPOC generated different impact on student groups of different sizes was examined and the results were provided in Table 5. The effect size of SPOC in a small, medium, and large student group was 0.932 (P=0.000<0.05), 0.715 (P=0.005<0.05), and 0.102 (P=0.125>0.05) respectively, indicating a significant positive effect of the intervention in small to medium sized student groups. The inter-group difference was also significant (Chi2=4.099, P=0.009<0.05), suggesting group size being a moderator for SPOC. Compared to small or medium groups, the effect value of SPOC intervention was not significant in large groups.

Table 3: The effectiveness of SPOC for differently-sized groups

Group size	No. of Studies	ES (SMD)	S.E.	95% CI		Test of null (2-Tail)		Inter-group effect size
				Lower limit	Upper limit	Z-value	P-value	
Small	8	0.932	0.221	0.536	1.335	4.213	0.000	Chi2=4.199 P=0.009
Medium	12	0.715	0.091	0.316	0.982	7.816	0.005	
Large	12	0.102	0.098	-0.276	0.354	1.041	0.125	

4.4.3 The influence of the length of intervention

We proposed the length of intervention being another moderating factor that influence the effectiveness of SPOC. Data analysis displayed in Table 6 rejected this proposal. The effect size of SPOC implemented for less than 2 months, 2-4 months, and more than 4 months was 0.624 (P=0.021<0.05), 0.689 (P=0.016<0.05), and 0.513 (P=0.028<0.05) respectively, indicating a significant effect of the intervention across time spans. The inter-group difference was not significant (Chi2 =1.096, P=0.578 > 0. 05). The integration of SPOC, in general, would improve student learning effectiveness regardless of its duration.

Table 4: The effectiveness of SPOC of different intervention length

Length of intervention	No. of Studies	ES (SMD)	S.E.	95% CI		Test of null (2-Tail)		Inter-group effect size
				Lower limit	Upper limit	Z-value	P-value	
Within 2 months	3	0.624	0.087	0.331	0.717	7.131	0.021	Chi^2=1.096 P=0.578
2 to 4 months	21	0.689	0.099	0.293	0.95	6.994	0.016	
more than 4 months	8	0.513	0.073	0.281	0.646	6.958	0.028	

4.4.4 The influence of knowledge type

This study also investigated whether the effect of SPOC was impacted by the type of the target knowledge in the intervention. As shown in Table 7, the effect size of SPOC for the learning of procedural knowledge was 0.630 (P=0.017<0.05), and for the learning of declarative knowledge was 0.348 (P=0.061>0.05). Compared to declarative knowledge, SPOC integration was effective in improving the development of procedural knowledge. This finding was consistent with the previous finding that SPOC was more effective in improving the learning of skill-based disciplines areas such as engineering technology and medical education which prioritized procedural

knowledge. With regard to the inter-group effect, the difference was not significant (Chi2=0.815, P=0.367>0.05). These findings, in combination, suggested that the knowledge type be a moderating factor for the effectiveness of SPOC, but its moderating effect should be limited.

Table 5: The effectiveness of SPOC for different types of knowledge

Knowledge type	No. of Studies	ES (SMD)	S.E.	95% CI		Test of null (2-Tail)		Inter-group effect size
				Lower limit	Upper limit	Z-value	P-value	
Procedural knowledge	14	0.630	0.050	0.533	0.728	12.626	0.017	Chi^2=0.815 P=0.367
Declarative knowledge	18	0.348	0.048	0.400	0.697	7.229	0.061	

5. CONCLUSION AND DISCUSSIONS

In this meta-analysis, 32 experimental and quasi-experimental studies on SPOC in vocational education published in China in the past 8 years were analyzed and combined. The results showed that: 1) Compared to traditional classroom-based instruction, SPOC had a moderate positive impact on learning with an effect size of 0.592; 2) The discipline area that SPOC intervened was a factor that moderated its effectiveness. SPOC had a larger effect size for the learning of disciplines of engineering technology and medical education, and the combined effect size reached 0.801 and 0.712 respectively; 3) The group size was another moderating factor. In a small to medium-sized group or class, SPOC was more effective. 4) The time SPOC spanned had no significant influence on its effectiveness. As long as SPOC was integrated, the learning outcomes would be improved. 5) Knowledge type was a third moderating factor. When SPOC was engaged in the learning of procedural knowledge, the learning outcomes were significantly improved, with an effect size of 0.630. Yet for declarative knowledge, such improvement was not significant, with an effect size of 0.348.

5.1 SPOC has a moderate positive impact for improving student learning in vocational schools.

The meta-analysis reveals that the combined effect size of SPOC for vocational education was 0.592, indicating a moderate positive effect. SPOC integrates diverse instructional resources online and offline, and affords more time and space for classroom-based instruction. Compared to traditional, classroom-based instruction, SPOC is conducive to in-depth learning, and will bring about significantly better outcomes. Our finding is consistent with previous research. Take English education in vocational schools for example. Yang, & Feng (2022) introduced SPOC to the instruction of English writing. The dynamic and sustainable learning environment established in the study that leveraged online open courses not only improved students' English writing skills and language use, but also contributed to the reform of English education in vocational schools enabled by information and communication technologies by providing an operatable and effective model (Broadbent, 2017; Li, 2019).

5.2 Moderating factors for the effectiveness of SPOC: Discipline area, group size, and knowledge type.

We hypothesized four variables that would influence the effect size of SPOC. Analysis results confirmed the significant regulating effect of three factors, including discipline area, group size, and knowledge type. Despite the overall significant effect of SPOC across discipline areas, the intervention worked significantly better for instructing disciplines in the areas of engineering technology and medical education than of natural science and humanities and social science. Effective instruction of engineering-related disciplines, such as computer technology, mechanical engineering, and construction technology, usually prioritizes the experiences and development of critical skills such as design-thinking and problem-solving. The online-based resources of SPOC, especially videos and simulations, enabled students to observe and navigate these critical processes thoroughly (Masud, & Huang, 2012). Moreover, as some of the instructional contents and tasks are shifted to online, out-of-class time, the teacher and students will have more time to interact, discuss, evaluate, reflect, and feedback in classroom-based instruction sessions. These affordances of SPOC probably account for its particular benefits to the instruction of skill-based disciplines. Applying SPOC to disciplines of medical education that also highlight the cultivation of critical competencies of scientific inquiry and problem-solving, such affordances also produce improved results.

The second moderating factor for the effectiveness of SPOC is the size of the student group or class that SPOC is applied to. The smaller the group, the larger the effect size. When SPOC is applied to a class of no more than 50 students, student learning outcomes will be significantly better than those in a traditional classroom. On the contrary, for a large class of more than 50 students, the effect of SPOC is not evident. Implementing SPOC to a small-scale of students is advantageous. One the one hand, in a small class, the teachers will have more time to observe, scaffold, and reflect to each individual student. The facilitation and guidance are more abundant and specific. On the other hand, compared to a large class, teachers for small or medium-sized classes, will have limited

workload in class management, homework correction and feedback, and evaluation and assessment, which leaves more time for them to develop and improve the instructional design and resources, and in turn contributes to better educational outcomes (Shen, & An, 2022).

The third factor that regulates the effectiveness of SPOC is knowledge type. For improving the teaching and learning of procedural knowledge, the integration of SPOC is significant, with a combined effect size of 0.630. For declarative knowledge, integrating SPOC can also improve student learning, with a combined effect size of 0.348, but the enhancement is not significant. Such discrepancy may be ascribed to the different characteristics and learning mechanisms of the two types of knowledge (Vo, Zhu, & Diep, 2017). Declarative knowledge is relatively abstract, and its development is mediated by processes of personal investigation, interactive discussion and negotiation, and further improvement through the collision of ideas (Lin, et al., 2017). Procedural knowledge is relatively structured, straightforward, and focused on the operation. The online platform may better complement the classroom-based instruction for the presentation, illustration, and further understanding of procedural knowledge.

With regard to the length of intervention, its moderating effect to SPOC is not significant. As long as SPOC is integrated, student learning in vocational education settings will be improved, regardless of its time of implementation. SPOC spanned more than 4 months will be slightly less effective than it is freshly introduced. This is probably because of the increasing familiarity with the blended model. Usually a novel, the innovative instructional model will enhance student motivation and enthusiasm, which provides the basis for effective learning (Li, & Wang, 2022). As time progresses, the effect of the novelty will decrease. But the overall impact of SPOC will not be compromised much.

6. IMPLICATIONS

This meta-analysis reveals that SPOC has a moderate positive effect for enhancing learning in vocational education, and supports wider application of this innovative blended learning approach. SPOC combines and leverages the strengths of both the online and offline learning spaces. Following this instructional model, the rich instructional resources and abundant opportunities for social interactions and self-directed learning embedded in the online platform are harnessed, and the learning mechanisms functioning in conventional classroom-based instruction are sustained (Richardson, Maeda, Lv, & Caskurlu, 2017). Adopting SPOC, student learning is more personalized, interactive, and facilitated, and therefore will be more effective (Saqr, Jovanovic, Viberg, & Gašević, 2022). Meanwhile, enrollment in vocational schools grows rapidly in recent years. For vocational educators, how to accommodate the increasing diversity of students in terms of knowledge structure, cognitive style, learning habits and alike becomes a big challenge (Castro, & Tumibay, 2021). Innovative instructional methods and models such as SPOC that provide abundant learning resources and support flexible time and space of learning should be further developed, evaluated and applied to meet the diversified needs of students. Vocational education institutions across levels and types should formulate plans for systemic implementation taking into account their specific context. And policy, technical and financial support should be devised and enacted to encourage, sustain and scale up these innovations.

6.1 Identify and harness the respective affordances of online and offline learning for designing and developing SPOC for different disciplines

According to this meta-analysis, SPOC has a moderate positive effect for improving learning across disciplines. It is also discovered that SPOC is more effective for the instruction of disciplines in the areas of engineering technology and medical education than in natural science, and humanities and social science, and more effective for learning procedural knowledge than declarative knowledge. The findings reflect both the value of SPOC and the areas for improvement in established practices. To further amplify the effect of SPOC across disciplines, more detailed analysis should be conducted to uncover the ingredients and mechanisms that contribute to the success or failure of a design and implementation. The online space and the classroom each possesses unique affordances to learning (Calderon, & Sood, 2020). Educational researchers and practitioners need to better understand the potentials and limitations of the two learning spaces, and organize and integrate them to maximize the positive effect. Meanwhile, the design and development of SPOC should also correspond to the characteristics and requirements of the discipline and the students. For example, students in vocational schools usually "work hard and love practice" (Nejkovic, & Tosic, 2018). Such learner knowledge should be accumulated and applied to SPOC design and development.

6.2 Plan for acculturation and control class size for better effectiveness

Despite the finding that the length of implementation of SPOC does not significantly affect its influence, similar to other educational innovations, a period of acculturation during which students gradually improve understanding of and proficiency in using the online platform, and develop the mindset and practices to integrate, bridge, and

leverage the two different learning modes blended in SPOC should be planned. Moreover, as group size is a significant moderator for the effectiveness of SPOC. The class size of SPOC should be limited to no more than 50 students. Privateness is one defining feature of SPOC, and we should maintain this feature by limiting the class size for better effectiveness.

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Educational and Social Impact of Computing Devices for Children with Autism Spectrum Disorder (ASD)

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ABSTRACT
The purpose of this study is to examine the perceptions of parents of children with autism spectrum disorder (ASD) about computing devices. Seven families with ASD children were interviewed about their children's use of computer devices and their impact on their academic and social behavior. Although parents raised concerns about internet addiction and cybersecurity, these devices were part of their children's daily routines and were used for educational and entertainment purposes. Occasionally, targeted activities such as video modeling have been used to address personal and social behaviors. However, the results suggested that parents were unprepared to help their children due to a lack of knowledge, community support, and resources.

INTRODUCTION
The National Institute of Mental Health (2018) defines autism spectrum disorder, also known as pervasive developmental disorders (PDDs), as a neurological and developmental disequilibrium that can be detected early in childhood and persists throughout life. Children share common symptoms that affect behavior, interaction, communication, and learning processes (Benson, 2016; Bouck, & Savage, 2014; Quest, 2016; Schultz et al., 2011). According to 2021 estimates by the Autism and Developmental Disabilities Monitoring (ADDM) network, approximately 1 in 44 children in the United States has been identified with ASD (Maenner, 2021). With this alarming growth in the ASD student population, parents face numerous challenges on how to better meet the specific needs of their children.

Parental involvement in the implementation of intervention strategies to support children with autism has a history of at least three decades (Schopler & Reichler, 1971; Rogers, 1996). It is believed that the more skills parents master, the higher the chances for their children to learn and cope with different situations. McConachie, & Diggle (2007) conducted an extensive review of research that focused on interventions for children aged 1 to 6 years. Their review of the literature found very few studies that had adequate research design to properly evaluate the effectiveness of a parent-led early intervention. They concluded that parent training can successfully contribute to intervention in young children with ASD. However, the review emphasized the need for more rigorous research in this area (Park, 2021; Lee & Meadan, 2021; Morsa, et.al., 2022; Tripathi, et.al., 2022).

The use of multiple computing devices has become common practice in most homes and schools to address the diverse learning and communication challenges of students with special needs (Arslan, et al., 2022). Some needs can be met by mainstream devices like a laptop, while others might require accessories and other technologies customized specifically for each student. Many new applications have been developed in recent years to address the diverse needs of ASD children, particularly to accommodate common communication and behavioral challenges (Bennett & Goodall, 2022; Syriopoulou-Delli et. al, 2022; Liu, et.al, 2022). These communicative apps are believed to help reduce frustration levels and encourage desired actions. However, like any other type of technology, these tools have limitations and different benefits for each ASD child with a variety of needs (Dahiya, et.al, 2021; Kollias, et.al, 2021; Sani-Bozkurt & Bozkus-Genc, 2012). If parents are not well informed about what constitutes a good application, they end up using apps that were either suggested by other parents or downloaded randomly (Hammer, et al., 2021; Mertala, 2019). As a result, their children use iPads or smartphones for entertainment and gaming instead of using them for the intended educational purposes.

THE STUDY
Purpose of the Study
The purpose of this study is to examine what parents of children with autism spectrum disorder (ASD) think about smart computing devices and the impact they have on their children's educational and social behavior. Seven families of children with ASD were recruited to participate in this study. Because each ASD case is unique, the goal of conducting in-depth interviews allows for an understanding of each family's experience. The interviews include shared stories, anecdotes, and specific details about the use of smart computing devices and how they impact their children's academic, personal, or social learning and behavior.

Design

This study followed a narrative research approach to gather details about the lived experiences of seven families. The purpose of the narrative research design is to tell the stories of a few individuals to obtain rich information and a profound understanding of their experiences (Clark & Creswell, 2017). For this study, we followed a set of procedures to collect data in the form of field text and audio-recorded conversations to describe the experiences and the lived challenges of parents of ASD children. The data analysis followed an analytical process to retell or 'restate' the data by identifying common story elements using the interviewees' own words.

Participants

Our participants are seven parents or guardians of children diagnosed with autism spectrum disorders. These families are located in rural counties in the Southwest United States. Participants were recruited through a variety of methods and strategies, including verbal prompts at ASD support group meetings and from various platforms and online media, as well as through snowball sampling. Each family was offered a small stipend for their participation.

Procedures

Seven families gave informed consent to participate in this study. The interviews were planned individually with each family. First, we met with each participant and walked them through the process, explaining the logistics of collecting data on their family members. The average interview length was about 45 minutes. The interview questions covered the educational and technical needs of parents of children with ASD and explored how technology and other new smart tools can support families. Each participating family was given a pseudonym and the interview data collected was stored anonymously. Recorded interviews were transcribed and converted from audio files into Word documents.

Analysis

The interview questions were semi-structured. Participants were given time and freedom to elaborate on their answers, leading to a series of follow-up questions. The choice of the semi-structured interview format helped feed the qualitative data with well-detailed stories and examples. Initially, parents were asked to share general information about their children with ASD and if they could add specific details about their children's special needs. They later answered questions about computing devices that parents use to support their children's academic development. They had an opportunity to share their use of other tech tools besides computers or smartphones to support their children with ASD.

We followed a thematic data analysis process aimed at identifying thematic patterns emerging from the interview data. Thematic data analysis involves constantly moving back and forth between the entire dataset, the coded data extracts, and the analysis of the produced data. (Braun & Clarke, 2006, 2014). One of the advantages of thematic data analysis is that it is a flexible method when following an inductive approach that can be used for this type of exploratory data analysis where the themes depend on the data. Specifically, in our study, we followed both semantic and latent levels of themes as proposed by Braun & Clarke (2006). Semantic themes are "the explicit or surface meanings of the data and the analyst is not looking for anything beyond what a participant has said or what has been written"' (p.84).

The data from the interview questions underwent a thematic analysis focused on how the computing devices are used and to what extent they support the children's educational and social behavior. Thematic analysis requires an iterative process of moving from raw data to a more structured and organized set of information that highlights the key themes in the data. The interview data analysis was first coded based on semantic topics. This analysis intended to identify the descriptive variables mentioned by the parents. In a second round, we created a second set of latent themes descended from the initial summative themes. This step involved looking for patterns or themes in the codes in all interviews and reviewing the themes. At this stage, we also looked more closely to not miss any underlying thoughts and assumptions from what the parents were saying. In a later step, researchers defined, named, and agreed on reliability issues after conducting a coding matrix cross-check. Finally, the research team prepared the collective analysis report.

FINDINGS

Educational Impacts of Computing Devices

Parents have considered computing technologies helpful and effective in supporting their children's educational needs. Most described their children as visual thinkers who are better with pictures and visual aids. They use images as their primary means of communication while words serve as their second language. Parents were aware that their children learn and communicate better when they look at pictures or words that help them visualize information. Additionally, one parent recommends that device usability should be "a visually appealing

device and apps that would not challenge them or add to their frustration". Certainly, the use of smart and adaptable technologies could facilitate learning and make visual imagery more accessible and meaningful for children with ASD.

Communicating needs seemed to be a dominant factor and all parents were primarily concerned with how to build better communication opportunities for their autistic children. One parent found that using text messaging was the most beneficial way to establish some form of communication with their non-verbal adolescent. She found that texting was a positive communication tool that her son used to let those around him know about his needs. However, another parent who also uses texting to communicate with their son mentioned that typing isn't always easier "The verbal communication can definitely get confusing…we do a lot of talking but especially if it's something serious, then I choose when I do it and how I do it." Two of our participants who have children with auditory sensitivity praised the flexibility of some devices to adjust to appropriate volume levels using an app like Noise Down, which automatically sets off an alarm when decibel levels get too high, or Too Noisy Pro, which notify users that the speaker volume is high.

Parents mentioned some benefits of computer devices that positively impacted their children's learning progress by reducing anxiety and frustration. Our participating parents noticed an improvement in their children's overall mood. In addition, frustration decreased for both their children and the parents themselves. Smart computing devices made everyday life easier and, above all, better communication. Improved fine motor skills were also mentioned as another benefit. Parents appreciated the precision of smart devices in assisting their children, especially those who struggle with fine motor skills, which make handwriting and drawing difficult. Parents also talked about the benefit of the voice input feature, which serves as auditory reinforcement for audiovisual learners, computer graphics help to visualize the words improving their reading skills. The joy of learning was also mentioned as an advantage. Using features like a keyboard, touchscreen, or speech-to-text app helped reduce the difficulties and frustrations traditionally associated with writing tasks, increasing individuals' enjoyment and motivation in learning. Pacing according to the learner's speed was also mentioned as another source of learning enjoyment, which is usually supplemented by playful visual aids.

Although our participants had different needs, backgrounds, and experiences, they all had a common reason why they would facilitate the use of computing devices with their children. Regardless of the varying nature and quality of educational use, all parents agreed that the primary purpose of making these devices available at home is to help their children catch up and learn at their own pace. Overall, many benefits can be gained from using computing devices and the parents can observe first-hand how these technologies improve their children's learning. Even if the educational gain is minimal, they think it worth it to invest in providing these devices to their children.

Social Impacts of Computing Devices

The data revealed several themes that parents found helpful in improving their autistic children's social skills. Parents have appreciated the help these devices offer in improving their children's organizational skills and accomplishing some daily tasks. For example, one parent spoke about how computer devices helped her to work with her autistic child "So I've done a lot of social stories – you can find apps for social stories. There was an app that helped us potty-train him that was a rewards-based thing". While video modeling has often been used to enhance children's daily routines such as showering and brushing, it has also been used to address educational and social behavior. A parent provided examples of how video modeling was used for educational and behavioral purposes "They've done it at school, at therapy, and we work on it at home. He was working on the 'th' sound and they emailed it to me and then I showed it on the computer himself which he really liked. And then… he tends to like to assimilate anything very quickly like if he sees himself. But at school recently they showed him something in the lunchroom that he didn't realize he had done and he was like 'oh I guess, yeah…' he was poking a kid or something or annoying him, not really realizing I think what he was doing, so they showed him the video of it and he was like 'oh my gosh, I didn't realize I was doing that,' so it's been good socially too, at school". Another parent highly praised the effectiveness of video modeling "… probably the biggest thing that I've found it being useful for is we do a lot of video modeling, so like when he's working social skill or we're like not transitioning well, I'll try to video him doing it properly and he re-watches it and it assimilates really well. So we're doing a lot of that at [therapy center] but also at home we use it. So we've seen that really helping."

Although parents highlighted a few concerns about their children's social vulnerability and their ability to read social situations and expressed frustration with the challenges of improving their children's social skills, the use of computing devices to support children in this area was limited. For example, one parent explained how the computing devices help his son's social interaction indirectly "He plays an educational math game (Prodigy) that

is like an online game where he can math battle other kids in his class, and that's the one that works him through the curriculum and so that's been good because he's accelerated his math skills but also he has something to talk about at school with his friends or other classmates. So that's been really good." However, another parent spoke about their endless efforts to integrate their 18-year-old autistic child into mainstream society by finding employment opportunities for him to build social interaction. However, her child lacks the endurance to hold a job due to a health condition, preventing him from fully immersing himself in the workforce. Another parent mentioned the challenges in this area "Things just have to be more concrete and visual all the time so in order to make something click, that's why I keep a whiteboard in my kitchen to draw out, map out, social things that we're working through or whatever. I do a lot of drawing and pictures and social stories".

CONCLUSIONS

This study was conducted to investigate what parents of children with ASD think about the use of computing devices to support their children's educational, behavioral, and social needs. Overall, despite their limited knowledge of the effectiveness of technology use, parents were favoring the use of smart technology. Parents acknowledged the need and the benefits these devices bring to their kids' daily routine. Although parents raised concerns about technology addiction and cybersecurity, these devices are used for educational and entertainment purposes. However, parents do not have enough knowledge or the required expertise to assist their children while using these smart devices. Occasionally, targeted activities such as video modeling have been used to address personal and social behaviors.

The data indicated that, overall, parents lacked the theoretical foundations of what constitutes effective educational use, and what resources (e.g., educational links, websites, applications, gadgets, software, programs, etc.) are available to them to support their children's educational, personal, and social needs. It is worth noting that all participants except one parent expressed their lack of knowledge on how to effectively support their children with computing devices and set safety standards for their use. Even though parents provided few implemented strategies to control technology overuse, such as setting up time limits and verbal cues, they raised worries about their inability to detect potential malicious links, lack of professional support, and inability to find research-based platforms that would help them better support their children's growth. The results also showed that there is a lack of communication between school and parents. Sometimes parents are not well informed about what kind of technologies are being used with their children at school and how to maintain and expand that use at home. Interestingly, as an effective source of feedback or technological support, parents mentioned that ideas were occasionally provided by child therapists who guide parents in using specific applications or devices to maintain impact between therapy centers and the home.

This study was significant in that it provided a platform for parents with ASD children to share their thoughts and concerns. Overall, despite their limited knowledge of the effectiveness of technology use, parents had positive perception towards the use and impact of smart technology on their autistic children. Learning from the parents' experiences helped us understand their practices in using computer technology at home with their ASD children. Notwithstanding the sample size limitation, this study helped to show how parents explored the use of computer technologies to solve challenges related to the needs of ASD children. The result highlights the problem areas that professionals and policymakers should address to provide equal learning opportunities to enhance the educational, behavioral, and social skills of autistic individuals. Although the benefits of these devices were recognized, parents were underprepared to help their children due to a lack of knowledge, community support, and resources. There is a clear need to better educate parents to use technology effectively to support their children's learning and overall development. Therefore, the lack of research related to technology training for parents of ASD children is an area worthy of further research (Anupama, et.al., 2022; Dahiya, et.al., 2022; Pierson, et.al., 2021; Soares, et al., 2021). There is also a need for research to explore effective practices tailored towards the specific needs of parents of ASD children.

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Effect of Open Educational Resources on Teaching and Learning as Perceived by Lecturers in Selected Nigerian Universities

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ABSTRACT
This study examined the level of lecturers' awareness and the extent of usage of open educational resources (OERs) for teaching and learning in Nigerian universities. A descriptive research design was adopted for the study. Multi-stage sampling technique was used to select two (2) universities (both federal and state-owned) that are running open and distance learning programmes in each of the six (6) geographical zones of Nigeria; and to select a total of one thousand four hundred and eighty-five (1,485) respondents. To guide the study, three research questions were raised and three hypotheses were formulated and tested at 0.05 level of significance. The main structured research questionnaire used in the study was titled: "Lecturer's Use of OERs Questionnaire" (LUOER; r=0.78). Data obtained were analysed using descriptive statistics of mean, standard deviation and inferential statistics of ANOVA. The findings revealed that lecturers were aware ($\pi = 3.06; SD = 0.72$) and ready to use ($\pi = 2.80; SD = 0.80$) OERs for education with ranges of identified challenges. Findings also revealed significant institutional affiliation differences in the extent of lecturers' awareness ($F_{(11,1484)} = 61.71$; $p = 0.00 < 0.05$), readiness ($F_{(11,1484)} = 32.90$; $p = 0.00 < 0.05$) and perceived challenges ($F_{(11,1484)} = 12.12$; $p = 0.00 < 0.05$) towards the utilisation of OER for education. Implications to meeting the global challenges were discussed. It was recommended among others that the ministries of education should sponsor periodic workshops and seminars to sensitize lecturers more on the availability and utilization of OER facilities for teaching-learning process..
Keywords: Students, OERs, awareness, readiness, OERs utilisation

INTRODUCTION
The history of higher education is getting updated day in day out due to the introduction of various educational models and programmes that could make the recipients who must be able to compete favourably with others from different parts of the world. Like in every other country of the world, Nigeria had her shares of correspondence schooling experience; which offered all sorts of programmes including teacher education programmes and law, the conventional traditional schooling of face to face and also, the current open and distance mode of education brought about by the witnessed shift in paradigm. It is through this open and distance learning (ODL) mode of education that the introduction of various educational terms such as asynchronous and synchronous; faceless and blended among others came to be. We currently live in challenging times as we transit to a new knowledge-based society virtually every day; courtesy of information technology. Very many educational resources are now fully accessible through different media formats via information and communication technologies (ICT) in terms of Web tools and search engines. Among the consequent impact is the introduction of Open Educational Resources (OERs) which opens and freely gives access to various course contents in many educational programmes to educators as well as learners. This is another innovation in the act of teaching and learning.

Today, there is no need for teachers to start from the beginning to build all the necessary materials for their classes when OERs are properly being utilised. By using OER, lecturers can easily supplement their lectures and learning materials with content that is already openly licensed and available for sharing. By sharing their own work as OER, lecturers can maximize the impact and visibility of their scholarly work across the global learning community. Recently, there has been a fair amount of studies examining the adoption of OER materials on students' academic achievement. A good number of findings found no significant difference between OER and commercial texts when measuring student's performance and progression such as Allen, Gusman-Alvarez, Smith, Gamage, Molinaro & Larsen, (2015), Hilton, Gaudet, Clark, Robinson and Wiley (2013); and Hilton, (2016). While on the other hand, findings indicated an improvement in performance and retention using OERs such as Hilton and Laman (2012), Robinson, Fischer, Willey and Hilton (2014). Factors responsible for these include lack of awareness of the teachers that OERs can be used to identify gaps in learners' understanding of concepts, effectiveness of materials, development of materials, and potential administrative roadblocks (Kersey,

2019). Successful adoption of OERs in tertiary institutions seems to depend on awareness, readiness and proper usage by the lecturers. There is a need to examine the level of lecturers' awareness and the extent of usage of OERs for teaching and learning in Nigerian universities.

STATEMENT OF THE PROBLEM

The problem this study addressed is the examination of the level of lecturers awareness and the extent of use of OERs for teaching and learning in Nigerian universities. In doing so, the specific areas of focus are level of awareness, degree of utilisation and encumbrances in OERs accessibility.

OBJECTIVES OF THE STUDY

The general objectives of this study are to find out the level of awareness and extent of OERs usage and their roles among the lecturers in higher institutions in Nigeria. Specific objectives of the study include to:

(a) establish the level of awareness of lecturers use of OERs for education.
(b) ascertain the level of lecturers' readiness towards the utilisation of OERs in education.
(c) Find out the challenges of lecturers towards the utilisation of OER for teaching.

RESEARCH QUESTIONS

The following research questions guided this study:

(a) What is the level of lecturers' awareness of the use of OERs for education?
(b) What is the level of lecturers' readiness towards the utilisation of OERs in education?
(c) What are the lecturers' perceived challenges towards the utilisation of OERs for teaching?

HYPOTHESES

The following hypotheses were tested at 0.05 level of significance:

Ho_1: There is no significant institutional affiliation difference in the extent of lecturers' awareness of open educational resources for teaching.

Ho_2: There is no significant institutional affiliation difference in level of lecturers' readiness towards the utilisation of OERs for education.

Ho_3: There is no significant institutional affiliation difference in lecturers' perceived challenges towards the utilisation of OER for teaching.

METHODS AND PROCEDURES

A descriptive research design was adopted for the study to establish the level of lecturers' awareness, readiness, utilisation and challenges of using open education resources (OERs) for teaching and learning in Nigerian universities. The population of the study consisted of all lecturers of federal and state dual mode and single mode universities across the federation in Nigeria. Multi-stage sampling technique was used to select two (2) universities (both federal and state-owned) that are running open and distance learning programmes in each of the six (6) geographical zones of Nigeria; and to select a total of one thousand four hundred and eighty-five (1,485) lecturers. The sampled institutions are To guide the study, three research questions were raised and three hypotheses were formulated and tested at 0.05 level of significance.

The structured research questionnaire used in the study was named: Lecturers' Use of OERs Questionnaire (TUOERQ). The "TUOERQ" questionnaire was made up of two sections (A and B). Section A was made up of demographic variables of the respondents such as Institutional Affiliation, Faculty, Department, Years of Lecturing, Gender and Highest Qualification while Section B contains four different sub-sections with 55 questionnaire items/statements that relate to awareness, readiness, utilisation and challenges of the OERs for education. Each of the items has a four-point modified Likert scale range from 4– 1. The validity of the questionnaire was established by the experts in the areas of Open and Distance Learning and Tests and Measurement. The reliability of the instrument was ensured through test-retest reliability of two weeks interval after the first administration. The coefficient values is 0.82. The Lecturers' Use of OERs Questionnaire (TUOERQ) was administered to the sampled academic staff of the selected universities.

The teacher's questionnaire was administered on the lecturers during the time the Conference Marking Exercise of the National Open University of Nigeria was taking place at the designated marking zones across all the six (6) geographical zones of the federation. The collected data were analysed using descriptive statistics of mean and standard deviation for the research questions while inferential statistical tools of ANOVA was used to test the null hypotheses.

RESULTS

Research Question 1:

What is the level of lecturers' awareness of the use of OERs for Education?

Table 1: Descriptive Statistics of the level of Lecturers' awareness of the use of OERs for Education

		Freq.	%	Mean	Std. Dev.
OER means no need to ask for further permission to use the resources.	NA	97	6.50	2.89	0.76
	NFA	233	15.70		
	A	895	60.30		
	FA	260	17.50		
	Total	1485	100.00		
OER means the resources are openly licensed.	NA	85	5.70	2.95	0.76
	NFA	213	14.30		
	A	881	59.30		
	FA	306	20.60		
	Total	1485	100.00		
OER means the learning resources are freely available to be used by anyone.	NA	48	3.20	2.99	0.78
	NFA	315	21.20		
	A	731	49.20		
	FA	391	26.30		
	Total	1485	100.00		
OERs are digital and non-digital materials that can be re-used for teaching-learning and research.	NFA	307	20.70	3.06	0.68
	A	787	53.00		
	FA	391	26.30		
	Total	1485	100.00		
I am aware that OERs can be used to improve my learners' academic performance.	NFA	215	14.50	3.18	0.66
	A	793	53.40		
	FA	477	32.10		
	Total	1485	100.00		
I am aware that OERs can promote class discussion and improve learners' experiences and presentation skills.	NA	26	1.80	3.13	0.71
	NFA	214	14.40		
	A	783	52.70		
	FA	462	31.10		
	Total	1485	100.00		
I am aware that OERs can be used to enhance lecturers' and learners' interaction.	NFA	330	22.20	3.12	0.74
	A	652	43.90		
	FA	503	33.90		
	Total	1485	100.00		
I am aware that OERs can be used to create customised learners' learning materials and incorporate interactive elements such as audio, video and self-assessment into the learning material.	NA	25	1.70	3.12	0.67
	NFA	177	11.90		
	A	878	59.10		
	FA	405	27.30		
	Total	1485	100.00		
I am aware that OERs are used to find, remix and three collections of web resources to my learners.	NA	25	1.70	3.04	0.67
	NFA	228	15.40		
	A	900	60.60		
	FA	332	22.40		
	Total	1485	100.00		
I am aware that OERs can be sued to provide personalised learning to student based on their learning style.	NA	26	1.80	3.03	0.68
	NFA	239	16.10		
	A	876	59.00		
	FA	344	23.20		
	Total	1485	100.00		
I am aware that OERs can be used to present learning content visually to learners in different languages.	NA	62	4.20	3.00	0.77
	NFA	255	17.20		
	A	789	53.10		

	FA	379	25.50		
	Total	1485	100.00		
I am aware that OERs can be used to provide customised materials and personalised feedback to my learners.	NFA	343	23.10	2.99	0.67
	A	812	54.70		
	FA	330	22.20		
	Total	1485	100.00		
I am aware that OERs can be used to enhance collaborative learning, gauge my learners' understanding of a topic or concept.	NA	26	1.80	3.18	0.69
	NFA	169	11.40		
	A	803	54.10		
	FA	487	32.80		
	Total	1485	100.00		
I am aware that OERs can be used to identify gaps in my learners' understanding of a concept.	NA	51	3.40	3.10	0.77
	NFA	224	15.10		
	A	735	49.50		
	FA	475	32.00		
	Total	1485	100.00		
GRAND MEAN and STANDARD DEVIATION				3.06	0.72

From Table 2, 97 (6.50%) of the lecturers were not aware that OERs mean no need to ask for further permission to use the resources, 233 (15.70%) were not fully aware that OERs mean no need to ask for further permission to use the resources, 897 (60.30%) were aware that OERs means no need to ask for further permission to use the resources while the remaining 260 (17.50%) of the lecturers were fully aware that OERs mean no need to ask for further permission to use the resources.

Among the respondents, 85 (5.70%) of the lecturers were not aware that OERs mean the resources is openly licensed, 213 (14.30%) were not fully aware that OERs mean the resources are openly licensed, 881 (59.30%) were aware that OERs mean the resources is openly licensed while the remaining 306 (20.60%) of the lecturers were fully aware that OER means the resources is openly licensed.

A small proportion of 48 (3.20%) of the lecturers were not aware that OERs mean the learning resources are freely available to be used by anyone, 315 (21.20%) were not fully aware that OERs mean the learning resources is freely available to be used by anyone, 731 (49.20%) were aware that OERs mean the learning resources is freely available to be used by anyone while the remaining 391 (26.30%) of the lecturers were fully aware that OERs mean the learning resources is freely available to be used by anyone.

Also, 307 (20.70%) were not fully aware that OERs are digital and non-digital materials that can be re-used for teaching-learning and research, 731 (49.20%) were aware that OERs are digital and non-digital materials that can be re-used for teaching-learning and research while the remaining 391 (26.30%) of the lecturers were fully aware that OERs are digital and non-digital materials that can be re-used for teaching-learning and research.

Again, 215 (14.5%) were not fully aware that OERs can be used to improve learners' academic performance, 793 (53.40%) were aware that OERs can be used to improve learners' academic performance while the remaining 477 (32.10%) of the lecturers were fully aware that OERs can be used to improve my learners' academic performance. The Table further reveal that 26 (1.80%) of the lecturers were not aware that OERs can promote class discussion and improve learners' experiences and presentation skills; 214 (14.40%) were not fully aware that OERs can promote class discussion and improve learners' experiences and presentation skills, 783 (52.70%) were aware that OERs can promote class discussion and improve learners' experiences and presentation skills while the remaining 462 (31.10%) of the lecturers were fully aware that OERs can promote class discussion and improve learners' experiences and presentation skills.

In all, 330 (22.20%) of the lecturers were not fully aware that OERs can be used to enhance lecturers' and learners' interaction, 652 (43.90%) were aware that OERs can be used to enhance lecturers' and learners' interaction while the remaining 503 (33.90%) of the lecturers were fully aware that OERs can be used to enhance lecturers' and learners' interaction of all the participating lecturers. Yet, 25 (1.70%) of the them were not aware that OERs can be used to create customised learners' learning materials and incorporate interactive elements such as audio, video and self-assessment into the learning material, 177 (11.90%) were not fully aware that OERs can be used to create customised learners' learning materials and incorporate interactive elements such as audio, video and self-assessment into the learning material, 878 (59.10%) were aware that OERs can be used to create customised learners' learning materials and incorporate interactive elements such as audio, video and self-

assessment into the learning material while the remaining 405 (27.30%) of the lecturers were fully aware that OERs can be used to create customised learners' learning materials and incorporate interactive elements such as audio, video and self-assessment into the learning material.

Just 25 (1.70%) of the them were not aware that OERs are used to find, remix and three collections of web resources to my learners, 228 (15.40%) were not fully aware that OERs are used to find, remix and three collections of web resources to my learners, 900 (60.60%) were aware that OERs are used to find, remix and three collections of web resources to my learners while the remaining 332 (22.40%) of the lecturers were fully aware that OERs are used to find, remix and three collections of web resources to my learners.

A small proportion, 239 (16.10%) were not fully aware that OERs can be used to provide personalised learning to student based on their learning style, 876 (59.00%) were aware that OERs can be sued to provide personalised learning to student based on their learning style while the remaining 344 (23.20%) of the lecturers were fully aware that OERs can be used to provide personalised learning to student based on their learning style. Also, 62 (4.20%) of the lecturers were not aware that OERs can be used to present learning content visually to learners in different languages, 255 (17.20%) were not fully aware that OERs can be used to present learning content visually to learners in different languages, 789 (53.10%) were aware that OERs can be used to present learning content visually to learners in different languages while the remaining 378 (25.50%) of the lecturers were fully aware that OERs can be used to present learning content visually to learners in different languages.

Also, 343 (23.10%) were not fully aware that OERs can be used to provide customised materials and personalised feedback to their learners, 812 (54.70%) were aware that OERs can be used to provide customised materials and personalised feedback to their learners while the remaining 330 (22.20%) of the lecturers were fully aware that OERs can be used to provide customised materials and personalised feedback to their learners.
Only 26 (1.80%) of the lecturers were not aware that OERs can be used to enhance collaborative learning, gauge my learners' understanding of a topic or concept, 169 (11.40%) were not fully aware that OERs can be used to enhance collaborative learning, gauge their learners' understanding of a topic or concept, 803 (54.10%) were aware that OERs can be used to enhance collaborative learning, gauge my learners' understanding of a topic or concept while the remaining 487 (32.80%) of the lecturers were fully aware that OERs can be used to enhance collaborative learning, gauge my learners' understanding of a topic or concept.

Just, 51 (3.40%) of the lecturers were not aware that OERs can be used to identify gaps in their learners' understanding of a concept, 224 (15.10%) were not fully aware that OERs academy can be used to identify gaps in their learners' understanding of a concept, 735 (49.50%) were aware that OERs academy can be used to identify gaps in their learners' understanding of a concept while the remaining 475 (32.00%) of the lecturers were fully aware that OERs academy can be used to identify gaps in my learners' understanding of a concept. Averagely, Lecturers were aware (Grand mean = 3.06) of the proper use of OERs for Education.

Research Question 2:
What is the level of Lecturers' Readiness towards the Utilisation of OERs in Education?

Table 2: Descriptive Statistics of the level of Lecturers' Readiness towards the Utilisation of OERs in Education

		Freq.	%	Mean	Std. Dev.
I will encourage my learners to use OERs to connect with their peers to address subject specific questions and answers which are verified by over a thousand moderators who recommend a peer that can offer hints to get the correct answer	NFR	140	9.40	3.25	0.61
	R	835	56.20		
	FR	510	34.30		
	Total	1485	100.00		
I am ready to use OERs such as smart board to promote class discussions and improve learners' experiences and presentation skills	NR	12	.80	3.21	0.64
	NFR	140	9.40		
	R	856	57.60		
	FR	477	32.10		
	Total	1485	100.00		
I am prepared to use OERs learning platforms such as Google classroom to enhance lectures' and learners' interaction	NR	12	.80	3.21	0.67
	NFR	179	12.10		
	R	780	52.50		
	FR	514	34.60		
	Total	1485	100.00		
I would like to use OERs learning platform like Netex learning to create customised learners' learning materials and incorporate	NR	12	0.80	3.03	0.69
	NFR	301	20.30		

interactive elements such as audio, video and self-assessment into the learning material	R	804	54.10		
	FR	368	24.80		
	Total	1485	100.00		
I am ready to use OERs such as gooru and learning platform to find, remix and share collections of web resources to my learners	NR	25	1.70	3.04	0.68
	NFR	238	16.00		
	R	880	59.30		
	FR	342	23.00		
	Total	1485	100.00		
I use OER robots to provide customised answers in response to learners' messages, grade their performance, and provide tips on what area learners need to improve	NU	295	19.90	2.41	0.94
	RU	477	32.10		
	U	527	35.50		
	OU	186	12.50		
	Total	1485	100.00		
Am prepared to use OER automated facial recognition like biometric face scanning surveillance to automate attendance roll marking in class and during examination	NU	415	27.90	2.16	0.91
	RU	519	34.90		
	U	450	30.30		
	OU	101	6.80		
	Total	1485	100.00		
I use OER software such as Turnitin to assess, provide feedback to learners and ascertain their level of plagiarism	NU	256	17.20	2.55	0.97
	RU	418	28.10		
	U	549	37.00		
	OU	262	17.60		
	Total	1485	100.00		
I use OER powered cameras to track student's movements and monitor learners' facial expressions, enhance automating examination supervision	NU	391	26.30	2.21	0.94
	RU	533	35.90		
	U	424	28.60		
	OU	137	9.20		
	Total	1485	100.00		
I use OER Write To Learn to evaluate the meaning, relevance of text and correctness of grammar and spellings of my learners' writing	NU	245	16.50	2.41	0.87
	RU	518	34.90		
	U	585	39.40		
	OU	137	9.20		
	Total	1485	100.00		
I use intelligent software such as Statistical Package for Social Science (SPSS) for immediate manipulation and computation of statistical and mathematical calculations	NU	61	4.10	3.13	0.81
	RU	227	15.30		
	U	659	44.40		
	OU	538	36.20		
	Total	1485	100.00		
I use Google scholar to quickly see the main journals, disciplines and authors that publish in my area of interest	NU	37	2.50	3.22	0.78
	RU	216	14.50		
	U	609	41.00		
	OU	623	42.00		
	Total	1485	100.000		
I use Grammarly Premium to automate proofreading, identify and correct errors in my writing while preventing plagiarism	NU	109	7.30	2.70	0.81
	RU	448	30.20		
	U	706	47.50		
	OU	222	14.90		
	Total	1485	100.00		
I use cited references search in Web of Science to monitor current development and track prior research in over 100 years' record and back files	NU	73	4.90	2.86	0.79
	RU	364	24.50		
	U	753	50.70		
	OU	295	19.90		
	Total	1485	100.00		
I use Scopus, a source neutral abstract and citation database, to generate precise citation search results and automatically create and	NU	110	7.40	2.62	0.84
	RU	593	39.90		

update my research profile	U	538	36.20		
	OU	244	16.40		
	Total	1485	100.00		
GRAND MEAN and STANDARD DEVIATION				2.80	0.80

From Table 2, 140 (9.40%) of the lecturers were not fully ready to encourage their learners to use OERs to connect with their peers to address subject specific questions and answers which are verified by over a thousand moderators who recommend a peer that can offer hints to get the correct answer, 835 (56.20%) were ready to encourage their learners to use OERs to connect with their peers to address subject specific questions and answers which are verified by over a thousand moderators who recommend a peer that can offer hints to get the correct answer to encourage their learners to use OERs to connect with their peers to address subject specific questions and answers which are verified by over a thousand moderators who recommend a peer that can offer hints to get the correct answer while the remaining 510 (34.30%) of the lecturers were fully ready to encourage their learners to use OERs to connect with their peers to address subject specific questions and answers which are verified by over a thousand moderators who recommend a peer that can offer hints to get the correct answer.
Just 12 (0.80%) of the lecturers were not full ready to use OERs such as smart board to promote class discussions and improve learners' experiences and presentation skills, 140 (9.40%) were not fully ready to use OERs such as smart board to promote class discussions and improve learners' experiences and presentation skills, 856 (57.60%) were ready to use OERs such as smart board to promote class discussions and improve learners' experiences and presentation skills while the remaining 477 (32.10%) of the lecturers were fully ready to use OERs such as smart board to promote class discussions and improve learners' experiences and presentation skills.

Also, 12 (0.80%) of the lecturers were not full ready to use OERs learning platforms such as Google classroom to enhance lectures' and learners' interaction, 301 (20.30%) were not fully ready to prepare to use OERs learning platforms such as Google classroom to enhance lectures' and learners' interaction, 804 (54.10%) were ready to use OERs learning platforms such as Google classroom to enhance lectures' and learners' interaction while the remaining 368 (24.80%) of the lecturers were fully ready to use OERs learning platforms such as Google classroom to enhance lecturers' and learners' interaction.

Only 12 (0.80%) of the lecturers were not full ready to use OERs learning platform like Netex learning to create customised learners' learning materials and incorporate interactive elements such as audio, video and self-assessment into the learning material, 301 (20.30%) were not fully ready to use OERs learning platform like Netex learning to create customised learners' learning materials and incorporate interactive elements such as audio, video and self-assessment into the learning material, 804 (54.10%) were ready to use OERs learning platform like Netex learning to create customised learners' learning materials and incorporate interactive elements such as audio, video and self-assessment into the learning material while the remaining 368 (24.80%) of the lecturers were fully ready to like to use OERs learning platform like Netex learning to create customised learners' learning materials and incorporate interactive elements such as audio, video and self-assessment into the learning material.

Again, 25 (1.70%) of the lecturers were not full ready to use OERs such as gooru and learning platform to find, remix and share collections of web resources to my learners, 238 (16.00%) were not fully ready to use OERs such as gooru and learning platform to find, remix and share collections of web resources to my learners, 880 (59.30%) were ready to use OERs such as gooru and learning platform to find, remix and share collections of web resources to by their learners while the remaining 342 (23.00%) of the lecturers were fully ready to use OERs such as gooru and learning platform to find, remix and share collections of web resources to their learners.
Also, 295 (19.90%) of the lecturers never used OER robots to provide customised answers in response to learners' messages, grade their performance, and provide tips on what area learners need to improve, 477 (32.10%) rarely used OER robots to provide customised answers in response to learners' messages, grade their performance, and provide tips on what area learners need to improve, 527 (35.50%) used OER robots to provide customised answers in response to learners' messages, grade their performance, and provide tips on what area learners need to improve while the remaining 186 (12.50%) often used OER robots to provide customised answers in response to learners' messages, grade their performance, and provide tips on what area learners need to improve.

Again, 415 (27.90%) of the lecturers never used OER automated facial recognition like biometric face scanning surveillance to automate attendance roll marking in class and during examination, 519 (34.90%) rarely used OER automated facial recognition like biometric face scanning surveillance to automate attendance roll marking in class and during examination, Among the participants,450 (30.30%) used OER automated facial recognition like

biometric face scanning surveillance to automate attendance roll marking in class and during examination while the remaining 101 (6.80%) often used OER automated facial recognition like biometric face scanning surveillance to automate attendance roll marking in class and during examination.

Only 256 (17.20%) of the lecturers never used OER software such as Turnitin to assess, provide feedback to learners and ascertain their level of plagiarism, 418 (28.10%) rarely used OER software such as Turnitin to assess, provide feedback to learners and ascertain their level of plagiarism, 549 (37.00%) used OER software such as Turnitin to assess, provide feedback to learners and ascertain their level of plagiarism while the remaining 262 (17.60%) often used OER software such as Turnitin to assess, provide feedback to learners and ascertain their level of plagiarism.

Also from the table 2, 391 (26.30%) of the lecturers never used OER powered cameras to track student's movements and monitor learners' facial expressions, enhance automating examination supervision, 533 (35.90%) rarely used OER powered cameras to track student's movements and monitor learners' facial expressions, enhance automating examination supervision, 424 (28.60%) used OER powered cameras to track student's movements and monitor learners' facial expressions, enhance automating examination supervision while the remaining 137 (9.20%) often used OER powered cameras to track student's movements and monitor learners' facial expressions, enhance automating examination supervision.

A small fraction, 245 (16.50%) of the lecturers never used OER Write To Learn to evaluate the meaning, relevance of text and correctness of grammar and spellings of their learners' writing, 518 (34.90%) rarely used OER Write To Learn to evaluate the meaning, relevance of text and correctness of grammar and spellings of their learners' writing, 585 (39.40%) used OER Write To Learn to evaluate the meaning, relevance of text and correctness of grammar and spellings of my learners' writing while the remaining 137 (9.20%) often used OER Write To Learn to evaluate the meaning, relevance of text and correctness of grammar and spellings of their learners' writing.

Just 61 (4.10%) of the lecturers never used intelligent software such as Statistical Package for Social Science (SPSS) for immediate manipulation and computation of statistical and mathematical calculations, 227 (15.30%) rarely used intelligent software such as Statistical Package for Social Science (SPSS) for immediate manipulation and computation of statistical and mathematical calculations, 659 (44.40%) used intelligent software such as Statistical Package for Social Science (SPSS) for immediate manipulation and computation of statistical and mathematical calculations while the remaining 538 (36.20%) often used intelligent software such as Statistical Package for Social Science (SPSS) for immediate manipulation and computation of statistical and mathematical calculations.

Only 37 (2.50%) of the lecturers never used Google scholar to quickly see the main journals, disciplines and authors that publish in my area of interest, 216 (14.50%) rarely used Google scholar to quickly see the main journals, disciplines and authors that publish in their area of interest, 609 (41.00%) used Google scholar to quickly see the main journals, disciplines and authors that publish in my area of interest while the remaining 623 (42.00%) often used Google scholar to quickly see the main journals, disciplines and authors that publish in their areas of interest.

With this, 109 (7.30%) of the lecturers never used Grammarly Premium to automate proofreading, identify and correct errors in my writing while preventing plagiarism, 448 (30.20%) rarely used Grammarly Premium to automate proofreading, identify and correct errors in their writing while preventing plagiarism, 706 (47.50%) used Grammarly Premium to automate proofreading, identify and correct errors in their writing while preventing plagiarism while the remaining 222 (14.90%) often used Grammarly Premium to automate proofreading, identify and correct errors in my writing while preventing plagiarism.

Also, 73 (4.90%) of the lecturers never used cited references search in Web of Science to monitor current development and track prior research in over 100 years' record and back files, 364 (24.50%) rarely used cited references search in Web of Science to monitor current development and track prior research in over 100 years' record and back files, 753 (50.70%) used cited references search in Web of Science to monitor current development and track prior research in over 100 years' record and back files while the remaining 295 (19.90%) often used cited references search in Web of Science to monitor current development and track prior research in over 100 years' record and back files.

On this, 110 (7.40%) of the lecturers never used Scopus, a source neutral abstract and citation database, to generate precise citation search results and automatically create and update their research profiles, 593 (39.90%)

rarely used Scopus, a source neutral abstract and citation database, to generate precise citation search results and automatically create and update their research profile, 538 (36.20%) used Scopus, a source neutral abstract and citation database, to generate precise citation search results and automatically create and update their research profiles while the remaining 244 (16.40%) often used Scopus, a source neutral abstract and citation database, to generate precise citation search results and automatically create and update their research profiles.
Averagely, Lecturers were ready and used (Grand mean = 2.80) OERs in Education.

Research Question Three:
What are the lecturers' perceived challenges towards the utilisation of OERs for teaching?

Table 3: Descriptive Statistics of Lecturers' Perceived challenges towards the Utilisation of OER for Teaching

		Freq.	%	Mean	Std. Dev.
My university is a contributor to OER's repositories	SD	84	5.70	2.73	0.79
	D	459	30.90		
	A	710	47.80		
	SA	232	15.60		
	Total	1485	100.00		
My university encourages both staff and learners to use OERs	SD	36	2.40	2.94	0.69
	D	287	19.30		
	A	891	60.00		
	SA	271	18.20		
	Total	1485	100.00		
My university sponsors academic staff to national / international conferences / workshops on OERs / professional development trainings	SD	109	7.30	2.80	0.82
	D	353	23.80		
	A	755	50.80		
	SA	268	18.00		
	Total	1485	100.00		
I have benefited from my university sponsorship to OERs conferences/training workshops	SD	266	17.90	2.33	0.88
	D	608	40.90		
	A	462	31.10		
	SA	149	10.00		
	Total	1485	100.00		
My university has provided for official permanent unit, equipped with human and material resources on OERs matters	SD	170	11.40	2.54	0.89
	D	582	39.20		
	A	500	33.70		
	SA	233	15.70		
	Total	1485	100.00		
GRAND MEAN and STANDARD DEVIATION				2.67	0.81

From Table 3, it could be deduced that larger number of lecturers 942 (63.40%) with mean and standard deviation of 2.73 and 0.79 respectively agreed to the fact that their universities were contributors to OER's repositories, 1162 (78.20%) with mean and standard deviation of 2.94 and 0.69 respectively agreed to the fact that their universities encouraged both staff and learners to use OERs, 1023 (68.80%) with mean and standard deviation of 2.80 and 0.82 respectively agreed to the fact that their universities sponsored academic staff to national / international conferences / workshops on OERs / professional development trainings, 874 (58.80%) with mean and standard deviation of 2.33 and 0.88 respectively disagreed to the fact that they have benefited from their university sponsorship to OERs conferences/training workshops while 752 (50.60%) with mean and standard deviation of 2.54 and 0.89 respectively disagreed to the fact that their universities had provided for official permanent unit, equipped with human and material resources on OERs matters.

Testing of the Hypotheses
The following null hypotheses were formulated and tested at 0.05 level of significance.
Ho_1: There is no significant institutional affiliation difference in the extent of lecturers' awareness of open educational resources for teaching.
Ho_2: There is no significant institutional affiliation difference in level of lecturers' readiness towards the utilisation of OERs for education.

H_{O3}: There is no significant institutional affiliation difference in lecturers' perceived challenges towards the utilisation of OERs for teaching.

Table 4: Descriptive Statistics of Lecturers' Variables

		N	Mean	Std. Dev.	Std. Err.
Lecturers' Awareness of OERs	SW FEDERAL	125	30.46	5.57	0.50
	SW STATE	125	27.14	3.30	0.30
	SE FEDERAL	123	32.07	2.60	0.23
	SE STATE	121	32.37	4.09	0.37
	SS FEDERAL	126	29.97	4.11	0.37
	SS STATE	121	33.38	2.62	0.24
	NW FEDERAL	123	32.84	3.63	0.33
	NW STATE	121	33.37	2.71	0.25
	NE FEDERAL	130	26.60	5.59	0.49
	NE STATE	130	27.50	2.99	0.26
	NC FEDERAL	120	34.80	3.99	0.36
	NC STATE	120	30.90	3.16	0.29
	Total	1485	30.89	4.62	0.12
Lecturers' readiness towards utilization of OERs for Education	SW FEDERAL	125	13.30	3.29	0.29
	SW STATE	125	12.30	2.27	0.20
	SE FEDERAL	123	12.88	3.57	0.32
	SE STATE	121	14.14	3.88	0.35
	SS FEDERAL	126	12.84	2.49	0.22
	SS STATE	121	12.36	3.93	0.36
	NW FEDERAL	123	14.52	3.04	0.27
	NW STATE	121	14.29	2.10	0.19
	NE FEDERAL	130	13.20	3.70	0.32
	NE STATE	130	14.00	1.68	0.15
	NC FEDERAL	120	15.10	2.22	0.20
	NC STATE	120	13.00	3.11	0.28
	Total	1485	13.49	3.13	0.08
Lecturers' Challenges towards Utilization of OERs for Education	SW FEDERAL	125	12.23	1.65	0.15
	SW STATE	125	12.73	1.98	0.18
	SE FEDERAL	123	13.45	3.41	0.31
	SE STATE	121	13.64	4.63	0.42
	SS FEDERAL	126	12.70	2.50	0.22
	SS STATE	121	13.07	2.32	0.21
	NW FEDERAL	123	15.59	2.54	0.23
	NW STATE	121	12.92	2.31	0.21
	NE FEDERAL	130	13.20	1.95	0.17
	NE STATE	130	13.40	2.12	0.19
	NC FEDERAL	120	13.20	3.32	0.30
	NC STATE	120	14.00	2.42	0.22
	Total	1485	13.34	2.81	0.07

Table 5: ANOVA of Lecturers' Variables on Institutional Affiliation.

		Sum of Squares	**df**	**Mean Square**	**F**	**Sig.**
Lecturers' Awareness of OERs	Between Groups	10007.95	11	909.81	61.71	0.00
	Within Groups	21718.27	1473	14.74		
	Total	31726.22	1484			
Lecturers' Readiness towards Utilization of OERs for Education	Between Groups	1675.33	11	152.30	32.90	0.00
	Within Groups	6818.14	1473	4.63		
	Total	8493.46	1484			
Lecturers' Challenges towards Utilization of OERs for Education	Between Groups	972.70	11	88.43	12.12	0.00
	Within Groups	10746.25	1473	7.30		

	Total	11718.95	1484		

Results in Tables 4 and 5 show that there were statistically significant institutional affiliation differences in the extent of lecturers' awareness of open educational resources for education ($f_{(11,1484)} = 61.71$; $p = 0.00 < 0.05$); level of lecturers' readiness towards the utilisation of OERs for education ($f_{(11,1484)} = 32.90$; $p = 0.00 < 0.05$) and lecturers' perceived challenges towards the utilisation of OERs for education ($f_{(11,1484)} = 12.12$; $p = 0.00 < 0.05$) based on institutional affiliation. The mean and standard deviation values also showed statistically significant differences in lecturers' institutional affiliation on the extent of lecturers' awareness of open educational resources for education, level of lecturers' readiness towards the utilisation of OERs for education and lecturers' perceived challenges towards the utilisation of OERs for education. therefore, we do not accept the null hypotheses that say that there is no significant institutional affiliation difference in extent of lecturers' awareness of open educational resources for education; there is no significant institutional affiliation difference in level of lecturers' readiness towards the utilisation of OERs for education and there is no significant institutional affiliation difference in lecturers' perceived challenges towards the utilisation of OERs for education. To determine the actual sources of significant differences observed in table 5, Scheffe post hoc test was employed.

DISCUSSION

The findings on the awareness of the OERs by the lecturers revealed that lecturers were aware of the proper use of OERs for education. They acknowledged the existence of OERs in their institutions as digital and non-digital resources that can be used to promote class discussion, enhance lecturers' and learners' interaction and improve learners' academic performance. This positive report is an important indicator to OERs utilisation. These findings were not in agreement with the earlier findings of Gunness (2011) who reported that the staff at the De Montfort University's Faculty of Health Sciences demonstrated a lack of familiarity with OERs. They only acknowledged the existence of open content repositories in their institutions but did not seem to be familiar with anything that was beyond the university (Farrow et al., 2015). The findings were supported by Jhangiani, and Jhangiani (2017) who examined awareness, usage, outcome, and perceptions of OERs among British Columbia post-secondary faculty and found that 78 (i.e. 77%) respondents had used OERs.

The findings on the level of lecturers' readiness towards the utilization of OERs in education indicated that lecturers were ready and used OERs in education. This was evident amongst the lecturers with the responses that they were ready to use OERs learning platforms like Netex to create customized learners' learning materials and incorporate interactive elements such as audio, video and self-assessment into the learning material. This finding is in agreement with the finding of Rolfe's (2012) who indicated that borrowing and sharing resources with one another were a common practice while obtaining materials from the internet was a normal phenomenon. The findings also confirmed with the submission of Afolabi, Adeyanju, and Adedapo (2010) in a study on media utilisation where lecturers expressed their views that they were happy to share resources freely available to other educators to use as they see fit. The findings of the study contradicted the position of Kanwar (2013) who highlighted the results of a key survey on the use of OERs in 13 Asian countries which indicated that lecturers lacked the capacity and time to locate, adapt and re-purpose OER materials that were relevant to them.

The findings on perceived challenges towards the utilization of OERs for teaching revealed that lecturers perceived their universities as being contributors to OER's repositories towards the utilisation of OER for teaching. Nonetheless, the lecturers indicated that their universities encouraged both staff and learners to use OERs, and sponsored academic staff to national/international conferences/workshops on OERs/professional development training. This implied that the level of lecturers' preparedness in tackling challenges towards the utilization of OERs for teaching is appreciable. These findings were not in agreement with the findings of Cox (2013) while revealing a key barrier to openness in the educational institutions that academics presented a certain amount of resistance in making educational content openly available as they observed very little value in sharing or contributing resources. Also, the finding of Oplatka (2007) revealed that for lecturers to become facilitators between new educational technologies, learning avenues such as OERs and student learning, developing countries need to address some fundamental problems: the poor qualifications of lecturers that affect teaching innovation and quality.

The first hypothesis examined if there is a significant institutional affiliation difference in the extent of lecturers' awareness of OERs for teaching. The finding showed that there were statistically significant institutional affiliation differences in extent of lecturers' awareness of OERs for education ($F_{(11,1484)} = 61.71$; $p = 0.00 < 0.05$). The mean and standard deviation values also showed statistically significant differences in lecturers' institutional affiliation in the extent of lecturers' awareness of OERs for education, Based on this, the null hypothesis was not accepted as it was shown that there was statistically significant difference in the extent lecturers' institutional affiliation influenced awareness of OERs usage for education. This finding is in agreement with the earlier

finding of Hassall & Lewis (2017), who conducted an online survey in 2016 of 209 academics involved in teaching anatomy and medicine in colleges and universities and reported that few academics indicated using OERs with minimal awareness that is relevant to key issues that prevent educators from blocking OERs in their teaching, while other academics exhibited a slight dispersion of the usage of OERs with inherent incentive barrier to adoption.

The second hypothesis examined if there is no significant institutional affiliation difference in the level of lecturers' readiness towards the utilisation of OERs for education. The finding revealed statistically significant institutional affiliation differences in the level of lecturers' readiness towards the utilisation of OERs for education ($F_{(11,1484)} = 32.90$; $p = 0.00 < 0.05$). The mean and standard deviation values also showed statistically significant differences in lecturers' institutional affiliation on the level of lecturers' readiness toward the Utilisation of OERs for Education. Therefore, we do not accept the null hypothesis that says that there is no significant institutional affiliation difference in the level of lecturers' readiness towards the utilisation of OERs for education. This implied that the findings indicate that the majority of institutions and lecturers who have used OERs had a positive experience and would do so again. The finding of this study corroborated Falode, Ilufoye, Awoyemi, and Usman (2018) who investigated lecturers' awareness and readiness toward the adoption of open educational resources for teaching in tertiary institutions in Niger State, Nigeria found that lecturers have a high awareness of OERs with a grand mean score above average and with the high grand mean score of readiness to adopt OERs in teaching.

The third research hypothesis examined if there is a significant institutional affiliation difference in lecturers' perceived challenges towards the utilisation of OERs for teaching. The finding revealed statistically significant institutional affiliation differences in lecturers' perceived challenges towards the utilisation of OER for education ($F_{(11,1484)} = 12.12$; $p = 0.00 < 0.05$) based on institutional affiliation. The mean and standard deviation values also showed statistically institutional affiliation significant differences in lecturers' perceived challenges towards the utilisation of OER for education. Therefore, the null hypothesis was rejected. This finding is in line with the earlier finding of Mtebe and Raisamo (2014), who examined barriers to OERs use in 11 Higher Education Institutions (HEI) in Tanzania. In their study, experiential data were generated through semi-structured interviews with random samples of 92 lecturers and a review of important documents. Many higher education institutions also spend huge sum of finances to maintain various ICTs on their premises given these efforts to the use of OERs.

CONCLUSION AND RECOMMENDATIONS

This research has aimed to contribute to our understanding of how university lecturers perceived and utilized the available OERs as only this could justify the resources expended on their acquisition. There were basis to conclude that several and varied factors abound testifying to it that lecturers in Nigerian universities are at various degrees of awareness level, utilisation, and readiness to adopt OERs. The level of lecturers readiness for, and awareness of OERs is very highly encouraging and could be further improved upon by attending to a few prevailing challenges.

In line with the findings of the study, the following are the recommendations:

(i) The ministries of education should sponsor periodic workshops and seminars to sensitize lecturers more on the availability and utilization of OER facilities for teaching-learning process.

(ii) The National Universities Commission may need to include availability, feasibility and use of the OERs as additional condition for the accreditation of programmes and universities.

(iii) Universities managements may need to put up institutional comprehensive policy on OERs such that lecturers could be encouraged to donate resources.

(iv) Modalities to provide free access to data within the campus environments need to be worked out for the lecturers.

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Evaluation of Online Education in the Era of COVID-19 Pandemic: A Review from Students, Parents, and Teachers' Perspectives

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ABSTRACT
Qualitative content analysis is used in this study to review related online education since the outbreak of COVID-19. The aim of this study was to summarize the impact of online teaching on the education industry during the pandemic, sum up the viewpoints of all kinds of people to draw conclusions, and conclude the practical countermeasures. Based on the result of the analysis, firstly, we think that students and teachers are satisfied with online education, but parents have expressed dissatisfaction with this kind of education. Secondly, this paper lists the advantages and common problems of online teaching during study at home from different aspects. According to deficits, we summarize the solutions from three aspects: network equipment, teaching, and self-adjustment. This research is of great significance. It is not only beneficial to the development of educational platforms and personalized teaching but also helps formulate education policy to reduce the burden of education.
Keywords: Online education, COVID- 19, qualitative content analysis, academic performance, countermeasures

INTRODUCTION
At the end of 2019, there was an outbreak of pneumonia of unknown cause in Wuhan, China, which was considered the most widespread epidemic in nearly 100 years (Kang et al., 2020; Lu et al., 2020). It was later confirmed that the disease was induced by SARS-COV-2, which belonged to the Beta coronavirus genus of the family Coronaviridae (To et al., 2021). It was a pleomorphic enveloped virus studded with distinctive spikes (Chan et al., 2020). The symptom of Coronavirus disease 2019 （COVID- 19）was not specific, including cough, fever, and difficulty breathing (Gao et al., 2021; Ilkhani et al., 2021). As the progressed, it turned out that the disease was

transmitted primarily through mucus secretions, droplets, and direct contact (Habas et al., 2020; Zhang et al., 2020). It could spread in other ways, such as, touching the objects with the virus and then touching their mouth, eyes, and nose (Rothe et al., 2020). There was a study that confirmed the presence of viruses in stool and blood swabs (Rothe et al., 2020). There has been a lot of vaccination (Ilkhani et al., 2021). But from the point of epidemiology, the effective ways to stop the spread of the virus were isolation, contact tracing, social distancing, ongoing testing, and awareness-raising (Adedoyin & Soykan, 2020; Habas et al., 2020; Ilkhani et al., 2021). The sudden outbreak of the COVID-19 has disrupted the pace of people' s lives. In order to stop the spread of the COVID-19, people had to keep social distance and stay at home. Limited grouping made people turn traditional education into online education via the Internet to maintain the normal teaching process(Machado et al., 2020; Mumtaz et al, 2021; Wenceslao & Felisa 2021; Zhu et al., 2021).

Online learning referred to the use of the Internet and related technologies to develop and manage projects (Fry, 2001; Means et al., 2009). Usually, online learning included desktop computers, laptops, smartphones and other hardware as well as softwares such as email, video, video conference, learning management systems etc (Larreamendy-Joerns & Leinhardt, 2006; Wenceslao & Felisa 2021). Online education had a long history, originating in the United States in the 1800s (Mclsaac & Gunawardena, 1996; Sun & Chen, 2016). After the first World War, radio opened the door to distance education as a medium (Mclsaac & Gunawardena, 1996; Sun & Chen, 2016). In the late 1980s, due to the shortage of teachers, K-12 schools offered courses through satellite technology, stimulating the development of distance education (Mclsaac & Gunawardena, 1996; Sun & Chen, 2016). The emergence of world wide web was the milestone of online education (Mclsaac & Gunawardena, 1996; Sun & Chen, 2016). Technology innovation and the speed of the Internet make the use of online education higher and higher. As early as 2010, 89% of four-year colleges offered full online and blend programs, according to prior studies (Parker et al., 2013). 32% of students enrolled in high education in 2013 had taken at least one online course (Sun & Chen, 2016). Online education was rapidly sweeping the education market with its flexibility, customization, economy and accessibility (O'Donoghue et al., 2004; Palaigeorgiou & Papadopoulou, 2019; Smedley, 2010). But, Due to the rapid spread of the new coronavirus, the way of education changed overnight. People had to stay at home and took classes using online teaching and other methods via the Internet. This has also raised concerns about the quality of online teaching (Hodges et al., 2020).

Due to the massive use of online education during the pandemic, people were interested in the effect of online learning has become a heated topic of the society with numerous discussions around it. What was the academic performance of students undergoing online courses? What did teachers and parents think about the online education? What were the successes had been achieved and what were the mistakes had been made? Although there was much literature that had studied the satisfaction, teaching quality and grades in detail, there was no overall summaries and generalized these views. Thus, we took the lead in conducting a compressive review to answer the confusion about online education and to summarize some of the achievements and shortcomings of online education so far, dissecting the viewpoints of all sides, such as, students, teachers and parents. In addition, our articles also tried to put forward feasible suggestions based on existing problems. Subsequent teaching could be applied effectively and achieve remarkable results.

METHODOLOGY

Research Design

This study reviewed relevant studies on online education, including qualitative research, quantitative research and mixed research since the COVID-19 outbreak. The groups studied included students, teachers and parents. The research covers kindergarten, primary and secondary schools and universities, and it involves different disciplines. The online education defined a learning style in which learners did not need to learn in bricks-and-mortar classrooms. The terms online learning, online teaching, online education, online course could use interchangeably throughout the article.

Study selection and research question

The sources of primary literature were full-text and journal articles. The purpose of the review was to summarize the influence of online learning strategies for academics and evaluate the effect of online education in the era of COVID-19 pandemic. We included articles since 2019. The primary literature was collected by online databases. The search databases, including Pubmed, Conchrane, Embase, Medline, Web of science, CNKI and WanFang, would be conducted. Each database used the same retrieval strategies and keywords "Online education" AND "COVID-19" were used as search terms.

The process of selecting studies was presented in flowchart (Fig. 1). The search yielded 964 records. Eleven articles were excluded because of duplication. Three hundred and fifty articles were excluded because they did not meet the inclusion criteria after screening the title and abstract. Six hundred and three articles were assessed for

eligibility through full-text screening, and sixty-three records were further analyzed at last. The reasons for excluding the rest of the articles were as follow: 210 articles did not report the results related to educational quality and satisfaction, 48 studies including protocol, review and conference articles were eliminated, 42 studies were conducted with the disabled, 189 studies did not include the students, teachers, parents at school, 51 studies were exploratory analyses of influence factors of online education.

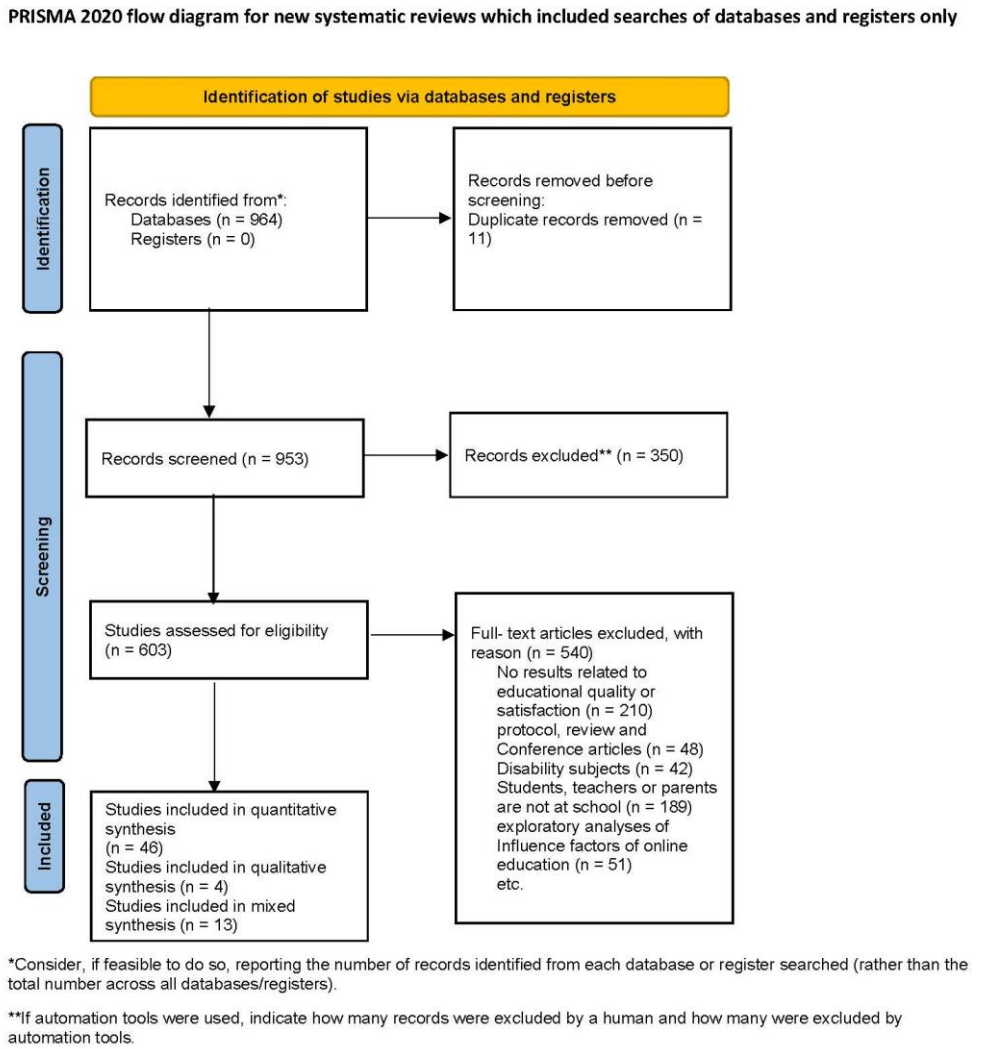

Fig. **1** flow diagram depicting article selection.

According to the selection criteria, we included sixty-three articles to answer our questions (Table 1): (1) What is the impact of online learning strategies on academic performance? (2) What are the advantages or disadvantages

of online education? (3) What measures can be taken to address the adverse effects of online education?

Data analysis

The qualitative content analysis approach was applied to analyze data in this article (Cavanagh, 1997), and the result of research was organized into three important topics for answering questions, including the academic performance of online learning, the advantages or disadvantages of online education, and coping strategies.

RESULTS

RQ1. What is the impact of online learning strategies on academic performance?

The attitudes of students toward online education

Overall, students were satisfied with online learning by reviewing relevant literature. They thought online learning strategies were effective to make up for the lack of traditional learning strategies during home quarantine (Adarsh, 2020; Chung & Choi, 2021; Dana, 2021; Lan et al., 2021; Wang et al., 2021a; Wang et al., 2021b; Xiaoying & Qilan, 2020). Students reported that they could learn new knowledge and acquired new skills regardless of the way was educated (De la Fuente et al., 2021). Besides, students also said the quality of teaching did not deteriorate because faculty prepared lessons carefully even during distance teaching (Dana., 2021). Some researchers measured the academic performance of students and they found students' test scores did not go down even some got higher scores than the traditional teaching (Alabdulwahhab et al., 2021; Gopalan et al., 2021; Mahabubul & Morsheda, 2021; Manna et al., 2021; Mortezaei et al., 2021). Thus, somebody said online learning was an excellent way to replace the teaching in bricks-and-mortar classrooms (Generali et al., 2021; Lan et al., 2021). In addition, due to the impact of epidemic, the assessments of teaching results were carried out online, basically. Students praised it for being efficient, accurate and a good reflection of their levels (Cernicova-Buca & Dragomir, 2021; Xiaoying & Qilan, 2020).

However, there was still some disagreements about online courses (Baltà-Salvador et al., 2021; Generali et al., 2021; Wenceslao & Felisa, 2021; Zhongren & Sakinah, 2021). A small number of students showed dissatisfaction with online learning, and they thought this way was less beneficial to study, especially, in laboratory courses and clinical skills training in medical profession (Dietrich et al., 2020). The reasons might be that the learning process was hindered because they had no chance to take part in the experiments and practices (Fazean et al., 2021; Wang et al., 2021a). Studies found that seniors were also affected. On the one hand, they have lacked practice courses leading to lower scores (Osamudiamen et al., 2021). On the other hand, the lack of this part was a disadvantage for them to find a job (Mahabubul & Morsheda, 2021; Susan et al., 2021). In addition, students reported that lower motivation and lack of interaction with teachers and students all contributed to the decline in academic performance (Asgari et al., 2021; Damijana et al., 2021).

The attitudes of teachers toward online education

Upon investigation, it was found teachers' satisfaction with network teaching is a medium level (Chung & Choi, 2021). They reported that they improved their ability to operate the computer, learned the new teaching technique, broadened the horizon, improved the quality of teaching, enhanced the learning experience, raised the level of innovation through online teaching (Fazean et al., 2021; Karla et al., 2021). Besides, teachers said they gained higher motivation for career and self-confidence (Denisova et al., 2020). Researches had been done and found the instructors were satisfying with online courses than students (Osamudiamen et al., 2021; Yang et al., 2020).

But others reported that it was not certain that online education was an effective and feasible way (Osamudiamen et al., 2021; Rome & Ryan, 2020). Firstly, they often had problem on operating software of teaching, and which made them annoyed (Armon et al., 2021; Asgari et al., 2021). Secondly, teachers could not percept students' ability of learning accurately and not sure online courses leading to the decline in academic performance in order to make an unbiased assessment (Chung & Choi, 2021; Dietrich et al., 2020; Osamudiamen et al., 2021). Thirdly, teachers agreed that online education was more effective for non-practical courses which were same with the students' point of view (Osamudiamen et al., 2021). Because students could not get skills and decrease their practical ability. Finally, they feedbacked that they had more works to do when preparing for online courses (Chung & Choi, 2021; Dietrich et al., 2020; Fazean et al., 2021).

The attitudes of parents toward online education

Parents had negative attitudes toward online education basically (ZhongRen et al., 2021). They believed that their children could not get a good education, especially for children at young school age (Fontenelle-Tereshchuk, 2021). Primarily, students had difficulty in concentrating and parents were not capable of teaching (Fontenelle-Tereshchuk, 2021). Posteriorly, parents needed to raise their families so that so they could not give their children enough emotional supports and it was difficult of switching roles between the career and mentoring their kids (Fontenelle-Tereshchuk, 2021). In addition, the teaching time was too short and they lacked of effective communication with teachers were also an annoyance (ZhongRen et al., 2021).

RQ2. What are the advantages or disadvantages of online education?

The advantages of online education

- Through investigating different population via surveys, the advantages of saving time and cost, and people with poor health getting same education (Alamer & Alharbi, 2021; Arshad et al., 2021).
- Learning materials could be obtained quickly (Cioruța et al., 2021).
- Arranged their time freely, had time to exercises and companied their families (Fazean et al., 2021).
- Teaching methods were living, interesting and attractive (Mishra et al., 2020).
- Video and courseware could be watched repeatedly (Mishra et al., 2020).
- Developed the ability to teach themselves and plan their studies at their own pace (Mahdy, 2020).
- Prepared courses with ample time and developed technique literacy (Fazean et al., 2021).

The disadvantages of online education

Through primary literature, common drawbacks of online education were as follows:

- Working in front of the computers was bad for health (Mahdy, 2020; Arshad et al., 2021; Francisco et al., 2021).
- Cheating on exams was on raise (Osamudiamen et al., 2021; Rome & Ryan, 2020).
- Had higher level of stress and even symptoms of depression and anxiety (Denisova et al., 2020; Loda et al., 2020; Zhongren et al., 2021).
- Lacked interaction with teachers to get feedback about academic performance slowly (Arshad et al., 2021; Yang et al., 2020).
- Due to the phenomenon of a digital gap, not everyone had good electronics (Pesha & Kamarova, 2020).
- Networks failures and technique difficulties caused disruption of courses (Asgari et al., 2021; Giulia & Amin, 2021; Muflih & Abuhammad 2020; Wang et al., 2021a).
- Lacked clinical teaching and practical teaching (Mishra et al., 2020).
- Reduced the time of study, and video or audio was played only to copy with attendances (Ji & DoHwan, 2021).
- Information was uncertain and scarce (Loda et al., 2020).
- The time of examinations being too short and the types of examinations being limit would cause panic (Mahdy, 2020; Wenceslao & Felisa, 2021).
- Teachers did not know if students were working hard (Rome & Ryan, 2020).
- Students had difficulties to manage their time (Giulia & Amin, 2021).
- The discussions among students were impersonal and feelingless (Rome & Ryan, 2020).
- It was difficult to find teachers and teaching assistants (Giulia & Amin, 2021).

RQ3. What measures can be taken to address the adverse effects of online education?

Countermeasures from the aspects of equipment

Firstly, schools can buy a batch of computers and rent them out to students at low prices (Asgari et al., 2021; Baltà-Salvador et al., 2021; Mahdy, 2020;). Some schools are already doing this to help students from poor families finish their courses on time. Secondly, schools can provide the wireless internet at low prices or free in order to provide supports of network to online education (Asgari et al., 2021; Cernicova-Buca & Dragomir, 2021; Mahdy, 2020). These measures can reduce the negative impact caused by the digital gap which is the most important obstacle in online education (Chand et al., 2021; Harum et al, 2004). And they prevent students who cannot afford internet fees losing the opportunity of education. In addition, it is important to choose suitable software that is well received and widely used for live broadcast or recording, such as, Zoom, Massive Open Online Courses (MOOCs), Tencent meeting, etc (Cioruța et al., 2021). This can prevent network outages or software glitches from delaying education. Creating shared web platform is also important, in which students can send and receive materials timely, make examinations easily, watch courses repeatedly and communicate with their classmates and teachers conveniently (Cioruța et al., 2021).

Countermeasures from the aspects of teaching

According to the inadaptation to online education reported by students and teachers, we put forward some countermeasures in terms of teaching. It is necessary to conduct uniform training and discussion for teachers (Chung & Choi, 2021; Muhterem et al., 2021). The training should include the use of software, troubleshooting network faults, methods of online teaching and basic quality of education. The choice of teaching method is crucial (Baltà-Salvador et al., 2021). Correct teaching methods can fully stimulate the enthusiasm of teachers and students, for example, in flipped classroom where students prepare the courses and teach by themselves (Gopalan et al., 2021). The methods that are interesting and live can reduce pressures on teachers to prepare lessons and immerse students in learning.

Teachers can adapt flexible assessments to evaluate the ability of learning. It might be a good idea to replace traditional closed-book examinations with open-book examinations (Osamudiamen et al., 2021). Firstly, using flexible test questions, such as essays or short answer questions rather than fill-in-the-blank or multiple-choice questions which there are a lot of cheating on this kind of problems (Osamudiamen et al., 2021). Secondly, quizzes can be used instead of final exams (Chung & Choi, 2021). In this way, students can be assessed at any time and teachers can percept the learning ability of students clearly. At the same time, it effectively puts an end to students' s distraction in remote teaching.

Solving the problem of online education without practical learning is difficult. Medical students, for example, are unable to perform surgery. This may induce a negative impact in their future work. So, schools can use the technique called virtual reality to simulate surgery if they can (Cabassa & Haas, 2020; Mahdy, 2020; Nicolas Dietrich et al., 2019; Xu et al., 2020). In this way, students can master the operating process, experience the process of practice and reduce the inconvenience to the maximum extent. This also lays foundation for future offline teaching.

In the post-epidemic era when many schools have resumed offline learning gradually, schoolers tried to adopt a mixed approach that combined face-to-face education and online education in order to achieve better effect. And they tested results that students had higher satisfaction and better scores of final examinations than traditional and online teachings (Mahabubul & Morsheda, 2021; Nathaniel et al., 2021; Wen et al., 2021).

Countermeasures from the aspects of psychological problems

Because of the panic caused by the COVID-19 and the long period of home quarantine, people's psychological burden become heavier and heavier, and even symptoms of depression and anxiety appear. Some research show that unhealthy mental state will lead to the decline of learning efficiency (Kimura et al., 2020; Zhang et al., 2020). Therefore, we should pay attention not only to academic performance but to mental health. The follow suggestions seem to be helpful to deal with the current difficulties encountered.

For schools, online courses include not merely specialized courses but also mental health courses. Such courses can teach students some knowledge about psychology, identify different mental states and offer advices on prevention (Nicholas et al., 2021). In the meanwhile, school's mental health center should open the online counselling channels (Nicholas et al., 2021). Through the network appointment way, teachers and students can carry out psychological counselling at home. Counselling can be a way to work through their negative emotions and explore themselves.

For themselves, they need to stay healthy. Moderate exercises and careful diet are closely related to keeping pleasant mood and healthy body (Carvalho & Gois, 2020; Dwyer et al., 2020; Lee et al., 2020). Some researches show that dopamine is released after exercise, which is essential for boosting happiness effectively (Chaouloff, 1989; Marques et al., 2021; Meeusen, 2005). Furthermore, mindfulness and meditation are also helpful for relaxation (Behan et al., 2020; Luberto et al., 2020; Matiz et al., 2020). Some apps offer meditation features that people can practice on command. In the end, social support is the best way to help people out (Elmer et al., 2020). So, trying to communicate and share life with families and friends to maintain health is critical.

DISCUSSION AND CONCLUSION

Our research has made important contributions to the field of online education during the epidemic. Online education has been grown and got mature driven by the Internet, science and market. Especially, during the COVID-19 pandemic, its usefulness is growing because home isolation leads to school interruptions. Due to the flexibility, accessibility and affordability, online teaching seems become the best alternative plan. In the future, it will continue to grow, and its influences will continue to expand. At present, the epidemic is still raging and there is still a need for distance education. Therefore, schools and teachers should fully consider the ideas in this paper when developing teaching strategies to avoid difficulties in adapting to campus life and losing the ability to learn independently when switching to offline teaching. In addition, parents' views are also crucial and should be fully taken into account in terms of their work and life pressures. And course schedule should be as flexible as possible. Through the full cooperation of all parties, the best teaching effect can be achieved.

The aim of this research is to clarify what people think about online education. At first, we discuss the satisfaction with online education of students, teachers and parents, evaluate the quality of online teaching and feasibility of online courses. In the second pace, we have listed the advantages and disadvantages of online education, not only in terms of academics, teaching and learning, but also in terms of the ease and inconvenience it brings to life, as well as its psychological and health effects. At last, based on the shortcomings of online teaching that have been summarized so far, we proposed targeted and constructive suggestions to achieve the most ideal solutions to the

educational effect.

IMPLICATIONS AND LIMITATION

This is the first comprehensive review that summarizes the impact of online education in the COVID-19 era. As we all know, education is not something that can be done alone. It requires the cooperation of diverse groups in different industries, and positive interaction between teachers, students and parents. Teachers need to prepare teaching content, organize teaching framework, and make assessment in time. Students are the receptions of education who need accepting knowledge and use it flexibility. Parents provide supervision, feedback and guidance. The great advantages of this article are attracting the attention from diverse groups and no limitations to one aspect. This will attract more attention and importance to online education, which is conducive to the future development of online teaching. Besides, we find the diverse needs for online teaching and learning, which are conducive to development of educational platforms and making personalized teaching services in order to ensure the right and equity of education during the COVID- 19. And for policy makers, it is important to be references in policy making to reduce the burden on country, which is caused by education at the time of crisis. The government can focus on prevention and vaccine development.

However, there are still some deficits in this research. At first, this is only a qualitative study without quantitative analysis. Therefore, we lack data to support our view of point, which may lead to skepticism. In the second place, although this article summarizes the current situation of education in different countries, we do not break it down by race, by gender, by educational level. These factors may lead to different views, but we do not take into account in the literature. At last, disable people must have more difficulties and problems to solve than normal people in receiving knowledge during the epidemic. However, we exclude the studies because of the complexity of the analysis. In further, research can focus on the comparing the difference in viewpoints and demands of race, educational level and gender. It is necessary to conduct an in-depth study on educational situation of the disabled. It is also important to understand the perceptions of people with disabilities about online education and its impact on their education during the period of segregation. As for research method, scholars can adopt the method that try to combine qualitative analysis with quantitative analysis in order to make research more scientific and less skeptical, which not only synthesis the views of all side but also provide evidence of causation. Finally, we have not mentioned in this article how learning of student, teaching conditions of teacher, and attitudes of parents have changed subsequently in the post-epidemic era, following changes in teaching methods. In the current social context, the prevention and control of the new epidemic is a constant battle, so it is necessary to continue to follow up and update this topic.

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Table 1 Basic information of reviewed articles

Author	country	Major	Education levels	Research method	Participants type	Software	Brief summary
Alghamdi 2021	Saudi Arabia	pharmacy	college	quantitative	students	Rafid	The evaluation of technology access and online skill; the compare between The effect of online and offline teaching; how about the motivation for students
Ali Alamer 2021	Saudi Arabia	radiology	college	quantitative	students	Blackboard Collaboration, zoom	Assess the effectiveness of teaching radiology; exploring students' perceived satisfaction and concerns. Students'; attendance, grades, and frequency of technical difficulties.
Ali 2020	Saudi Arabia	pharmacy	college	qualitative	students	Twitter chat	Pharmacy students' perspective on its impact on their learning.
Armon 2021	Israel	ObGyn	college	quantitative	students and teachers	Zoom, Kahoot	Identify effective pedagogical modalities as well as obstacles to online learning.
Baltà-Salvador 2021	Spain	engineering	college	qualitative	students	NR	Engineering undergraduate students 's attitude toward quality of online classes, adaptation of the course, workspace conditions, emotion and the relationship between the contact and study and emotion at two points.
Banovac 2021	Croatia	anatomy	college	quantitative	students	NR	Compare the efficacy between different components of online and contact anatomy classes as perceived by medical students.
Boca 2021	Romania	economics	college	quantitative	students	edu.utcluj.ro, ZOOM, Microsoft Team	Determine the influencing factors of students' online education behavior; detect the attitude and satisfaction for quality of teaching.

Bogdan-Vasile 2021	Romania	different subjects	college	qualitative	students	NR	463 students are asked to answer three question: (1) describe online education; (2) like/dislike about online education; (3) propose for online education. And students are asked to have free discussion.
Cernicova-Buca 2021	Romania	different subjects	college	mixed	students	Zoom	Collecting data and discussing and interpreting results to evaluate the satisfaction and factor about online education
Chandrasinghe 2020	Sri Lanka	surgery	college	quantitative	students	Zoom	Investigate the effect of a new study methods learning outcomes and interest
Chung 2021	Korean	English language	college	mixed	students and teachers	PLC	Investigate how the sudden transition to online language teaching has influenced language instructors' teaching and assessment practice. Including questionary and discuss
Conway 2021	American	medical	college	quantitative	students and teachers	Zoom	Comparing the grades of two group (group A experience offline education in 2023; group B experience online education in 2020) by exam and fill the questionary about satisfaction
Cygan 2021	Chicago	nursing	college	quantitative	students and teachers	NR	The pandemic-enforced transition from face-to-face to remote learning impacts student
Daniela 2021	Canada	French language programs	elementary school	qualitative	parents	NR	Investigate attitude of ten parents whose children were at elementary school study French and disadvantages for them
De la Fuente 2021	Brazil	programming course	college	quantitative	students	Zoom	The research reported the teaching outcome of online programming course and given some recommendation

Dietrich 2020	Russia	Environment and Chemical Engineering	college	quantitative	students	Moodle	The aim of this research was to determine the effect of online education, including course and lab practice for students and teachers
Dindar 2021	Finland	NR	K-12 school	quantitative	teachers	Qridi LMS	Explore the factors facilitating online teaching technology and compare performance expectancy, effort expectancy, LMS self-efficacy and satisfaction between two group (experience and inexperience).
Ebohon 2021	Nigeria	NR	college	quantitative	Students and teachers	NR	Teachers and students in five college were surveyed to study virtual classrooms, course learning outcomes, alternative method of assessment, impact of online teaching and satisfaction.
Garg 2020	India	management and engineering disciplines	college	quantitative	students	NR	The attitude of learner toward online education; the acceptance of online learning only as a supporting tool to regular learning instead of as a substitute of the regular learning mode on the basis of various factors.
Gazi Mahabubul Alam 2021	Malaysia	Computer Science Application and Electrical and Electronics Communication	college	quantitative	students	NR	Compare the performance of academic and job-readiness two groups of graduates.
Generali 2021	Italy	Dentistry	college	quantitative	students	NR	Impact of COVID-19 toward academic career, risk of injection and the substitution of online education for traditional education of students in dentist subject.
Gómez Gómez 2021	Spain	Social Work, Social Education, Criminology, and Legal Sciences and Public Administration	college	mixed	students	MOOC	Adopt a mixed analysis to study students' performance in MOOC

Gopalan 2021	American	physiology course	college	quantitative	students	Zoom (Virtual flipped teaching)	Evaluate the effect of FT in satisfaction, grades, adjusting and discussion in course.
Mortezaei Haftador 2021	Iran	BSc nursing	college	quantitative	students	"synchronous online class/combination	Compare the effect of two teaching strategy (synchronous online class/combination of flipped and jigsaw methods) in nurse subject.
Hattar 2021	Jordan	Dentistry	college	quantitative	students	NR	Investigate online education experience, and the level of self-perceived preparedness for a range of cognitive, communication and professional skills.
Herr 2021	korean	Dentistry	college	quantitative	students	NR	Investigate the satisfaction and effect of online education toward the students learning dentistry
Idris 2021	Brunei Darussalam	health science	college	quantitative	students and teachers	Canvas、Microsoft Teams、Google Meet、Skype, Zoom	Investigate the learning experience for students and mental health and the teaching experience, mental health for teachers
Ishimaru 2021	Japan	NR	college	quantitative	students	NR	Evaluate the impressions of online education, study engagement, mental health, and lifestyle habits of students
Jiang 2021	China	pharmacy	college	quantitative	students	rain class and tencent meeting	Compare the satisfaction and grades of two class, 2017 (experience traditional education) and 2018 (mixed education).
Kang 2021	Korea	medical	college	mixed	students	Blackboard	Investigate the general experience, learning strategies, important features, and overall satisfaction of medical students

Karthik Vishwanathan 2021	India	medical	college	quantitative	students	Zoom and Google Meet	Evaluate the impact of online teaching using videoconferencing platforms on the education environment, satisfaction, and perception of the medical undergraduate students to online teaching.
Khan 2021	India	NR	secondary school	quantitative	students	Google Meet, WhatsApp, YouTube	Study the academic perception of students and positive/negative attitude
Wang 2021	China	Dentistry	college	quantitative	Students and teachers	ilab-x.com, MOOC, Rain Classroom, Tencent Classroom, Superstar Learning, Zoom	Survey the current online undergraduate education status in dental medicine in mainland China including theory and practical curriculum.
Li-a 2021	china	medical	college	quantitative	students	NR	Survey medical students' perspectives on online learning experience and challenge.
Li-b 2021	China	international medical and nursing	college	quantitative	students and teachers	NR	The factor influence the satisfaction of online education; Barriers and facilitators to online medical and nursing education.
Liu 2020	China	engineering, Science, Humanities, Art, and Social Science, Medical and Health Sciences	college	mixed	students and teachers	rain class	Evaluate the nature, quality, and outcomes of online learning using mixed methods and the participant including students, teachers and leaders.
Ma-a 2021	China	NR	Primary and secondary schools	quantitative	parents and children	NR	Evaluate the mental health and the effectiveness and attitudes towards online education among Chinese children aged 7–15 years
Ma-b 2021	China	NR	senior high school	quantitative	parents and children	NR	Evaluate the prevalence of post-traumatic stress disorder symptoms and attitudes towards online education in Chinese high school students.
Manna 2021	India	Medical and Allied Health	college	quantitative	students	Google platform, Edmodo and Zoom application	Evaluate the current online education practice, its effectiveness

Manou 2021	Greece	Pathology	college	quantitative	students	Skype for Business, YouTube	Explore participation and interactivity in a synchronous e-learning non-mandatory participation course.
Martín Ayala 2021	Spain	Psychology	college	quantitative	students	Google Meet, Moodle	Survey academic performance of psychology students in online education
Mishra 2020	India	NR	college	mixed	students	"MZU-LMS, Google Classroom, Zoom, Cisco WebEx, Google Meet, Skype, Webina, YouTube Video, YouTube, Facebook Streaming, WhatsApp, Telegram,	Study the perceptions of teachers and students on online teaching-learning modes
Mohamed 2020	Egypt	veterinary medical	college	quantitative	students	YouTube videos, university platforms, educational websites, and educational applications; Zoom (highest) WhatsApp, Google classroom, and social networks. Microsoft Teams, Edmodo, Skype, and Google Meet	Study the academic performance of veterinary medical students and researchers who experience online education
Moralista 2020	Philippines	NR	college	quantitative	teachers	NR	Determined the perception toward online education among faculty
Morgado 2021	Portugal	Dentistry	college	quantitative	students	NR	Assess dental students' self-perception, motivation, organization, acquired clinical skills, and knowledge using the online problem-based learning methods.
Nathaniel 2021	America	Medical Neuroscience Course	college	quantitative	students	Panopto	Compare students' performance in summative and formative examinations between adaptive blended learning activities and face to face learning
Pesha 2021	Russia	NR	college	quantitative	students	NR	Investigate the challenge, difficulty and satisfaction of online education

Punaji 2021	Indonesia.	NR	college	quantitative	students	Microsoft Team, WhatsApp	Compare the effect of Microsoft Team and WhatsApp in reading comprehension skills
Shrivastava 2021	India	Dentistry	college	quantitative	students	Microsoft Teams	Study academic outcome of online dental education and psychological and physical well-being of the students.
Shunit 2021	Israel	Gynecology Medical	college	quantitative	students and teachers	ZOOM	Assess the feasibility of an online clinical rotation in Obstetrics and Gynecology
Song 2021	China	NR	college	quantitative	students and teachers	NR	Examined the current opinions of online education from teachers and students
Suhaib 2020	Arab	health sciences	college	quantitative	students	Zoom, eLearning, School Portal, Moodle, Microsoft Teams, Email, Google Classroom, Online forum, WhatsApp, and Facebook.	COVID-19 affect attitudes about online education for undergraduate health sciences students.
Kim 2021	Korea	Medical	college	quantitative	students	ZOOM	Evaluate the assessment to and satisfaction with student clerkship.
Tao 2021	China	nursing	college	quantitative	students	MOOC, SuperStar Universal Learning	Compare their abilities in the process of new knowledge acquisition between traditional group, blended group and online group
Thom 2021	America	anatomy	college	mixed	students	NR	Evaluate the effectiveness and student perceptions of an online near-peer anatomy curriculum.
Szopi´nski 2022	Poland	business	college	quantitative	students	NR	Evaluation of online studies, the frequency of participation in online courses, and the preferences regarding the mode of study in the future.
Toti 2021	America	Computer Science	college	mixed	students	NR	Study the perception of the transition to remote teaching in a group of computer science students

Varma 2020	India	architecture programs	college	quantitative	students	Zoom, MS Teams, Whatsapp, NPTEL, SWAYAM ; EdX, Coursera, YouTube, Slideshare	Evaluated suitability of online teaching for architecture education
Wang-b 2021	China	Dentistry	college	quantitative	Students and teachers	Superstar Learning, Rain Classroom, Tencent Classroom; Pmphmooc, DingTalk, Zoom Meeting, Tencent Meeting	Survey satisfaction, necessity and efficacy of online education for dental education
Wenceslao 2021	Philippine	NR	college	mixed	Studnets and teachers	NR	Investigated the challenges to online engineering education in higher educational institutions
Xu 2021	China	English writing courses	college	mixed	students	Zoom or VooV meeting	Orientations towards written corrective feedback and their use of self-regulated learning writing strategies in online English writing course
Jiang 2021	China	English language	junior high school	mixed	students	Quizlet	Focused on the achievement and experience of Chinese EFL junior high school students
Zhu 2021	China	leadership course	college	quantitative	students	Blackboard Collaborate Ultra	Impact of online leadership course on students' learning outcomes and well-being.

Exploring Students' Engagement in Distance Learning During the Pandemic Of COVID-19: A Correlational Exploratory Design

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Abstract
This study aims to examine the students' level of engagement in distance learning during the pandemic of COVID-19. Among all learning models, students' engagement is considering a challenging factor, however this is particularly true in a remote learning environment. To obtain the research aims, a quantitative method, precisely Correlational Exploratory Design is conducted. Thus, a questionnaire is designed to collect the essential data from students. A total of (359) participants from Taibah University across different departments and programs were participated and completed self-report measures. The questionnaire consists of two main parts: first demographic questions, second different types of engagements (cognitive, behavioral, emotional, and social engagement) in distance learning. Making sense of these variables, enables reconsidering the decision-making regarding improving how distance learning is practiced for more successful and meaningful delivery. The result demonstrated that social engagement domain has been the only indicators of differences between gender in which female were more socially engaged than male, thus enhancing students' social engagement is a critical area to be considered. Moreover, the participants in this study measured cognitive engagement with 'strongly agreed' measure. While behavioral and social engagement were just agreed. However, emotional engagement was reported by them as natural. This finding indicated that the students were ready to shift to distance learning during COVID-19 and they need emotional support during this time. This study suggests recommendations on how to improve students' engagement.
Keywords: Students' engagement. Distance Learning. COVID-19, Quantitative method.

1. Context of Research: Distance Learning in Saudi Higher Education

The coronavirus (COVID-19) was first identified as a contagious disease in January 2020 (Sahu, 2020). For this purpose, the health authorities recommended that educational institutions to be closed (Moawad, 2020). However, "the implementation of distance education became the only choice for educational institutions to continue their academic activities during the COVID-19 pandemic" (Hassan et al., 2021, p. 2). Distance learning platforms have been used to facilitate learning during this COVID-19 crisis. There were many challenges for these platforms to be successed (Moawad, 2020). Therefore, it is important to understand how students learn and interact with the new learning experience.

Saudi Arabia was one of the recognized countries that provide online resources and training for educational institutions and families to use distance learning during this difficult time. There are many Saudi studies conducted to understand how students perceive the experience of fully adopting distance learning during the COVID-19 crisis. A study by (Al-Nofaie, 2020) showed that the students had high motivation levels towards using distance learning since they were aware of the importance of completing their degrees even though they may prefer in-class learning. (Bahanshal & Khan, 2021) studied the effect of COVID-19 on Education in Saudi Arabia and E-Learning Strategies. The result showed that most participants had positive attitudes toward E-learning and they were prepared to shift to online mode. Moreover, (Alshahrani, 2021) studied the readiness of using e-learning during the COVID-19 Pandemic. The study showed that the students were ready to shift to e-learning systems. The study also indicated that there was clear evidence that "universities originally adopting a blending learning system are more ready than their peers." (p.159). However, (Mahyoob, 2020) showed that students could not effectively interact with teachers during virtual classes.

1. Demographic Characteristics Impacts on Distance Learning

Demographic characteristics refer to attributes that describe the status of people or a person such as age, gender, ethnicity, or income. Prior studies have explored students' differences in distance learning among other factors

affecting academic performance. (Yu, Huang, Han, He, & Li, 2020) concludes that demographic information such as gender, level of study, and age has been a subject study in many research aimed to explore its impact in distance learning practice. Similarly (Ismail, Mahmood, & Abdelmaboud, 2018) reveals that students' demographic characteristics are among the most significant factors affecting the level of students' academic performance in distance learning. Subsequently, the need to ensure that learners are effectively and adequately engaged in the distance learning, exploring the impact of demographic characteristics impacts on students' engagement towards distance learning is a fundamental part of this study.

2. Students' Engagement in Distance Learning

Student engagement is defined as "the student's psychological investment in an effort directed toward learning, understanding, or mastering the knowledge, skills, or crafts that academic work is intended to promote" (Lamborn, Newmann, & Wehlage, 1992, p. 12). Because online students have fewer opportunities to engage with the school, it is critical to understand their engagement in distance learning. According to (Martin & Bolliger, 2018), Students' engagement in online courses improves their motivation and performance, as well as their sense of isolation. In this paper, we adopt Balwant's definition which is defining engagement as the involvement in academic activities that are highly motivated and enjoyable on emotional, behavioral, and cognitive levels (Balwant, 2018). There are various types of engagement (Cognitive engagement, behavioral engagement, emotional engagement, and social engagement), that will be reviewed to understand how students can achieve success in distance learning.

1.1 Cognitive Engagement in Distance Learning

Cognitive engagement refers to making all the necessary efforts to comprehend difficult ideologies. Cognitive engagement can be defined as "the integration and utilization of students' motivations and strategies in the course of their learning" (Richardson & Newby, 2006) p. 23). According to (Yundayani, Abdullah, Tandiana, & Sutrisno, 2021), research on cognitive engagement and distance learning examined students' cognitive abilities, motivations, and experiences. The finding of their study also showed that the students were taking more ownership of their education in distance learning environments. Moreover, one study showed that higher-level thinking is encouraged by distance learning when students write reflections using asynchronous technology (Erdoğdu & Çakıroğlu, 2021). In a study to identify the role cognitive engagement played in distance learning, the researchers suggest that online course instructors, tutors, and designers should offer students tailored motivational scaffolding depending on their motivational profiles (Riaz, Batool, Naeem, & Qayyum, 2021). The demands of each student must be examined in order to determine the learning tactics and motivations used by the learners in the distance learning platforms (Park & Yun, 2018).

Cognitive engagement affects how much time and effort one puts into their schoolwork and is a useful indicator of what motivates them. Park and Yun (2018) described self-regulation learning as a top type of cognitive engagement because students develop their learning solutions. According to this study, students had different strategies that enabled them to succeed in their online classes. Additionally, the study aimed to determine whether the students were enrolled in online courses from various programs that used differentiated learning and motivational tactics. The researchers concluded that there was a substantial variation in the students' strategies based on their programs. According to (Cho, Cheon, & Lim, 2021), self-regulated learning considers the pinnacle of cognitive engagement, in which students discover their answers. Interacting with the subject, students, and instructors has a favorable impact on students' progress in distance learning. Students' cognitive engagement would rise because of a well-designed distance course.

1.2 Behavioral Engagement in Distance Learning

Behavioral engagement is termed as the participation, attention, persistence, effort, and positive conduct of students in there learning activities (Kokoç, 2019). Behavioral engagement denotes the efforts and participation an individual exerts to participate in the distance learning platform such as attending the class and asking instructors to expound where they have not understood. According to (Riaz, Batool, Naeem, & Qayyum, 2021), behavioral engagement explains that many elements are present in student engagement in the classroom setting. Collaborative learning with peers is also a right way of improving the behavioral engagement of learners as they get to share their knowledge.

Technology tools may also affect the student's distance learning platforms. A study by (Tang & Hew, 2022) founded that using asynchronous technology tools promoted reflection. The researchers also indicated that online classes made students collaborate more with their peers. (Kokoç, 2019) implied that more interaction with online discussion positively impacted the performance of students learning through the online platform. The study's findings established that the flexibility in distance learning is expected to encourage students to engage more with learning content in their own pace, leading to high learning performance. The study deduced that for distance learning to work, the stakeholders had to come together and assist each other. Furthermore, students, in distance

courses, can participate step by step in the learning process. They are in the position of learning by doing. Students would use the online resources, which would push them to analyze and integrate the content of their work and share their personal views. This develops their ability to construct their own knowledge and share their thoughts, experiences, and cultures with their peers (Milman, 2020).

1.1 Emotional Engagement in Distance Learning

Emotional engagement is termed to involve affective reactions such as enjoyment, rejection, sense of belonging, interest, joy, satisfaction, attitude, anxiety, boredom, and frustration to students (Henritius, Löfström, & Hannula, 2019). The socio-emotional communication that establishes the social presence in distance learning is essential for the engagement of students. The use of humor in distance learning can positively impact reducing the levels of stress and increasing further the students' attention. During this COVID-19 pandemic, most students have difficulties in their distance learning process due to their emotional engagements in studies. The punctuation marks can express emotions on the students' keyboard during their interactions in online lessons. These emotions can be used to create a more social atmosphere in the distance learning classroom and create connections with fellow students (You, 2022).

Emotional engagement denotes the reaction of students towards their peers, instructors, and other academicians. Emotional engagement is all about making the distance learning programs interesting through participation in group discussions. (Hughes, Wickersham, Ryan-Jones, & Smith, 2002) state that distance learning can fail due to many issues that may limit the students' success and instructors in the online platform. To improve student performance and engagement, instructors must ensure students engage in collaborative learning with their peers.

Emotional engagement is the right way of ensuring students are engaging with the course material as more time spent interacting with the course material increases students' performance (Salta, Paschalidou, Tsetseri, & Koulougliotis, 2022). Instructors need to ensure all students do not feel isolated or left out of the online platform classes. By encouraging group work and participation in all classes, students can get emotional engagement with their peers as they have been availed with a grading rubric which enables them to engage in collaborative learning (Hughes et al., 2002).

1.2 Social Engagement in Distance Learning

Social Engagement denotes the process of engaging or getting involved in interactive online activities. Students who engage in distance learning are more likely to be socially active with their peers, instructors, and academicians (Bernard et al., 2009). According (Martin & Bolliger, 2018), “engagement strategies are aimed at providing positive learner experiences including active learning opportunities, such as participating in collaborative group work, having students facilitate presentations and discussions, sharing resources actively, creating course assignments with hands- on components, and integrating case studies and reflections” (p. 206). To boost social engagement in distance learning, there are three basic engagement techniques that have been identified: student-content, student- instructor, and student-student. These techniques help students become active and more engaged in their online courses (Bernard et al., 2009).

(Salta et al., 2022) study showed that students mostly engaged in student–faculty interaction. The study also found that most students in online classes collaborated at least sometimes. The study suggested future studies to find out what promotes engagement in the online environment. (von Goble, 2022) study indicated that instructors should consider designing interactive online assignments where students can engage with the content and with each other. The study also showed when instructors create multiple channels such as e-mails to students and discussion forums in which the instructor interacts, students have higher engagement in the course. (Dumford & Miller, 2018) study indicated that students “were less likely to engage in collaborative learning, student-faculty interactions, and discussions with diverse others, compared to their more traditional classroom counterparts” (p. 452). The study suggested that faculty should find ways to encourage student engagement across a variety of delivery types. (Martin & Bolliger, 2018) found that instructor’s presence is the most important element in online courses. The study concludes that instructors who were responsive and supportive and who listened and communicated with students were very appreciated by the students.

RESEARCH AIMS AND QUESTIONS

There has been little known how higher education students in Taibah University in Saudi Arabia interacted and engaged with their online courses during the coronavirus crisis. Hence, this research will address gaps in the literature by examining students’ engagements in distance learning in higher education in Saudi Arabia. As such, this study and its results may provide implications for designing best practices in online environment and provide suggestions for future studies. Therefore, this study was designed to first determine the significant relationship between student engagement in distance learning and their demographic characteristics. Second to investigate the

extent of which students are engaged with the experience of distance education based on (Behavioural, cognitive, emotional, and social) influences during the COVID-19 pandemic in the one Saudi university.

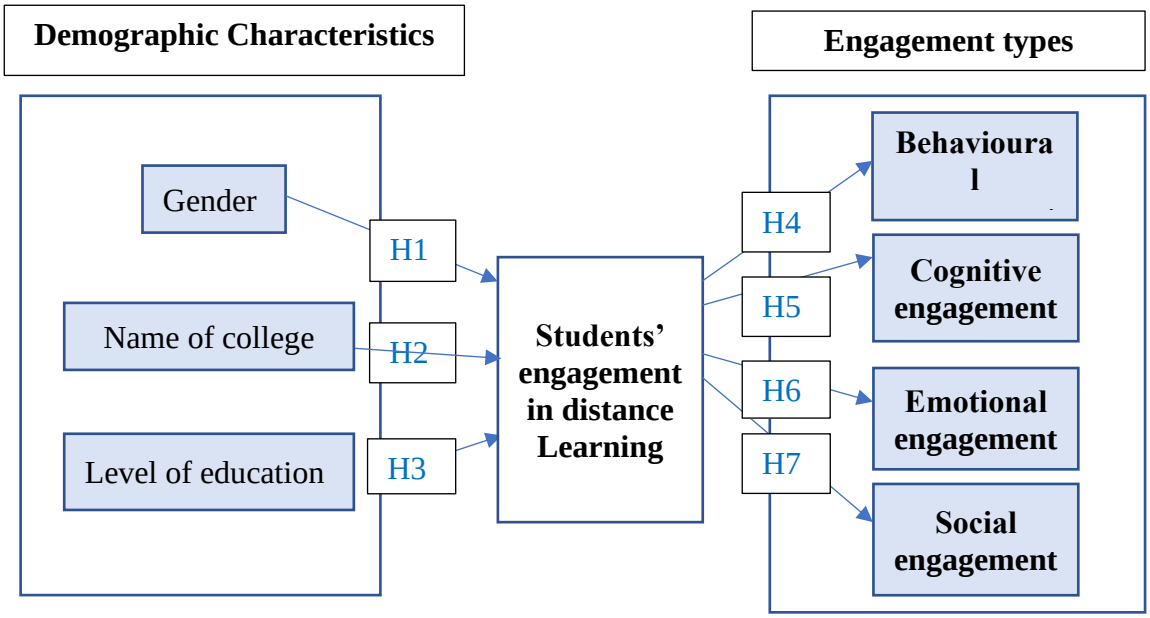
RQ1: what determents Saudi university students' (Behavioural, cognitive, emotional and social) engagement in distance learning based on their demographic characteristics?

H1: there is a significant difference in students level of engagement in distance learning and their gender
H2: there is a significant difference in students level of engagement in distance learning and their name of college
H3: there is a significant difference in students level of engagement in distance learning and their level of study

RQ2: To what extent Saudi university students are engaged with the experience of distance learning based on (Behavioural, cognitive, emotional, and social) influences?

H4: distance learning has a positive effect in students' behavioural engagement
H5: distance learning has a positive effect in students' cognitive engagement
H6: distance learning has a positive effect in students' emotional engagement
H7: distance learning has a positive effect in students' social engagement

Research framework



3.1 Methodology

To test the previous hypotheses and answer the research main questions, quantitative methodology has been found a constructive method. It is statistical representation of data that is collected and analyzed in numerical methods. It is useful when studying large group of people and thus generalize the finding to larger group (Swanson & Holton, 2005). Particularly, quantitative, correlational exploratory design is approached which is "a procedure in which the researchers hypothesizes a causal model and then empirically tests the model to determine how well the model fits the data" (Johnson & Christensen, 2013, p. 368), p.368). Therefore, it is a suitable method to test the relationship among the study's variables and their degree of association (Creswell, 2002). Creswell, 2002 asserts that "a correlational design in which the researcher is interested in the extent to which two variables co-vary" (p. 363). As a result, it is an appropriate design that aligns with the research fundamentals.

3.2 data collection: The tool of the study

The researchers used the anonymous questionnaire as a tool to collect data, due to its suitability of the study aims, its curriculum, and its society, and to answer its questions. The questionnaire is considered one of the most important means of collecting data and codified information, and the most reliable. Participation was voluntary, and all responses were anonymous. After reviewing the educational literature and previous studies related to the subject of the current study and considering the data and questions of the study and its objectives, the tool (the questionnaire) was designed, and it organized into two parts. The following is a presentation of how it was constructed, and the procedures used to verify its authenticity and reliability: The first section: It contains an introductory introduction to the aims of the study, and the type of data and information that researchers want to

collect from members of the study sample, while providing guarantees of confidentiality of the information provided, and pledging to use it for scientific research purposes only**.** The second section: It consists of (12) items, divided into four main axes, the following table clarifies the number of expressions of the questionnaire, and how they are distributed among the axes**.**

Table (1) axes and terms of the questionnaire

Axis	Number of items
Behavioural engagement	3 items
Cognitive engagement.	3 items
Emotional engagement	3 items
Social engagement	3 items
Questionnaire	12 items

Validity for the tool of the study

Truthfulness of the study tool means making sure that it measures what was prepared as intended to include the questionnaire for all the elements that are included in the analysis on the one hand, and the clarity of its expressions on the other hand, so that it is understandable to everyone who uses it. The researchers have made sure the study tool is validated by:

Validate the internal consistency of the tool

To verify the validity of the internal consistency of the questionnaire, the Spearman's Correlation Coefficient was calculated to determine the degree of correlation of each of the questionnaire expressions to the overall degree of the axis to which the item belongs, and the following tables show the correlation coefficients for each of the axes including their terms.

Table No. (2) Spearman correlation coefficients for first-axis expressions with the overall grade of the axis

(Behavioural engagement)			
Item number	Item	correlation coefficient	**Sig.**
1	I set aside a regular time each week to work on Blackboard.	.801**	**< 0.01**
2	I took notes while studying the Blackboard.	.857**	**< 0.01**
3	I revisited my notes when preparing for Blackboard assessment tasks.	.889**	**< 0.01**
(Cognitive engagement.)			
Item number	Item	correlation coefficient	**Sig.**
1	I often searched for further information when I encountered something in the Blackboard that puzzled me.	.684**	**< 0.01**
2	When I had trouble understanding a concept or an example, I went over it again until I under- stood it.	.800**	**< 0.01**
3	If I watched a video lecture that I did not understand at first, I would watch it again to make sure I understood the content.	.779**	**< 0.01**
(Cognitive engagement.)			
Item number	Item	correlation coefficient	**Sig.**
1	I often searched for further information when I encountered something in the Blackboard that puzzled me.	.684**	**< 0.01**
2	When I had trouble understanding a concept or an example, I went over it again until I under- stood it.	.800**	**< 0.01**
3	If I watched a video lecture that I did not understand at first, I would watch it again to make sure I understood the content.	.779**	**< 0.01**
(Emotional engagement)			

Item number	Item	correlation coefficient	**Sig.**
1	I was inspired to expand my knowledge in the Blackboard.	.831**	**< 0.01**
2	I found the Blackboard interesting.	.892**	**< 0.01**
3	I enjoyed watching video lectures in the Blackboard.	.895**	**< 0.01**
(Social engagement)			
Item number	Item	correlation coefficient	**Sig.**
1	I often responded to other learners' questions.	.827**	**< 0.01**
2	I contributed regularly to course discussions.	.876**	**< 0.01**
3	**I shared learning materials (eg, notes, multimedia, links) with other classmates in the Blackboard.**	**.710****	**< 0.01**

**Significant at 0.01

It is clear from the previous table that the values of the correlation coefficient for each of the items with their dimension are positive, and statistically significant at the level of significance (0.01) or less, which indicates the validity of the internal consistency between the statements of the first axis, and their suitability to measure what was prepared to measure it.

The validity of the study tool:
The validity of the study instrument was confirmed by using the validity factor of Cronbach's Alpha (α), the next table shows the values of the parameters of the validity of each of the questionnaire axes.

Table No. (3) Alpha Cronbach coefficient to measure the validity of the study instrument

Axes of the questionnaire	N	constancy
Behavioural engagement	3	**0.824**
Cognitive engagement	3	**0.659**
Emotional engagement	3	**0.845**
Social engagement	3	**0.773**
General constancy	**12**	**0.877**

It is clear from the previous table that the general validity coefficient is high as it reached (0.877), and this indicates that the questionnaire has a high degree of validity reliable. that can be relied upon in the field application of the study.

3.3 Quantitative data analysis
Quantitative analysis was performed whereas descriptive correlational technique employed to the collected data. Correlational research means to the discovery of relationships between variables. "Investigators use a correlation statistical technique to describe and measure the degree of associationbetween two or more variables" (Creswell, 2002, p. 361). To check the significant difference that found in factors that determines Saudi university students' engagement based on their demographic information, Mann-Whitney and Kruskal-Wallis tests have been used. To know the extent of Saudi university students engagment with distance education based on (Behavioural, cognitive, emotional, and social), iterations, percentages, arithmetic mean, standard deviations, and ranks for the responses of the members of the participants have been calculated on the terms of Saudi university students are actually engaged with the experience of distance education based on (Behavioural, cognitive, emotional, and social

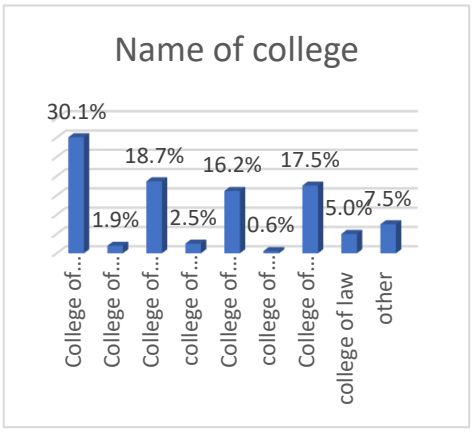
3.4 Research participants
The sample consisted of online students at Taibah university cross various courses and study level. A random technique was used for recruiting participants to ensure the generalizability of the research. A "simple random sample" was used to select a representative sample whereby the selection of the population's members was done equally; thus, the chance of being selected was equal across the target population (Johnson & Christensen, 2013). A total of (359) participants completed the online survey.

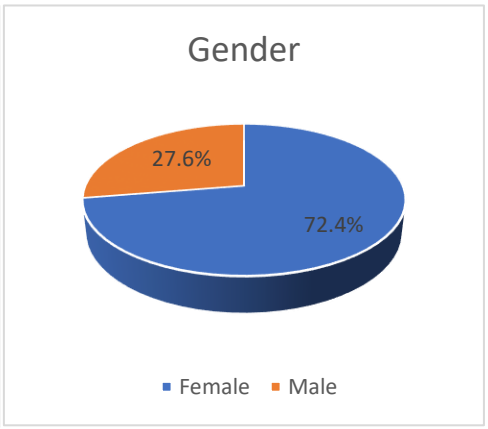
Characteristics of the individuals in the study sample:

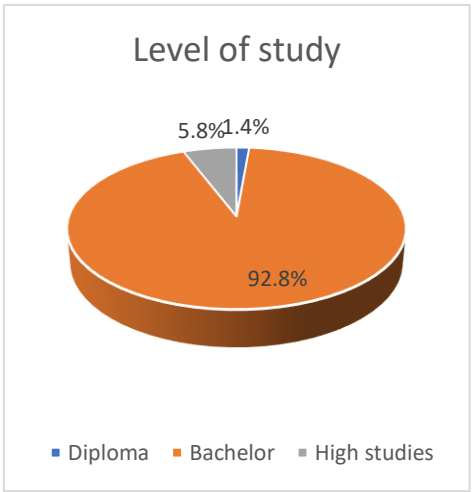
		Count	%
Gender	Female	260	72.4%
	Male	99	27.6%

Name of college	College of Computer Science and Engineering	108	30.1%
	College of Business administration	7	1.9%
	College of arts and Humanities	67	18.7%
	college of sceince	9	2.5%
	College of education	58	16.2%
	college of family sceince	2	0.6%
	College of applied Medical Science	63	17.5%
	college of law	18	5.0%
	other	27	7.5%
Level of study	Diploma	5	1.4%
	Bachelor	333	92.8%
	High studies	21	5.8%

The previous table indicate that 72.4% of the sample study were females. 30.1% of them study at Computer Science and Engineering college. 92.8% of them have a Bachelor. as indicated in the following figures:







Findings: hypothesis testing

- **H1: there is a significant difference in students level of engagement in distance learning and their gender**

Gender		N	Mean Rank	Mann-Whitney	Sig.
Behavioural engagement	Female	260	186.44	11196.000	0.054
	Male	99	163.09		
Cognitive engagement	Female	260	177.30	12167.000	0.416
	Male	99	187.10		
Emotional engagement	Female	260	180.30	12791.500	0.929
	Male	99	179.21		
Social engagement	Female	260	189.15	10491.500	0.006
	Male	99	155.97		

$\alpha = 0.05$

No significant difference in **behavioral engagement, cognitive engagement, emotional engagement** because the sig. value of Mann-Whitney test (0.054, 0.416, 0.929) frequently greater than 0.05, so we accept the null hypothesis which refer to no significant difference in **engagement** with level of confidence 95%. However, there was found a significant difference in **social engagement** because the sig. value of Mann-Whitney test (0.0006) less than 0.05, so we reject the null hypothesis and accept the alternative one which refer to there was found a significant difference in **social engagement** with level of confidence 95%.

- **H2: there is a significant difference in students level of engagement in distance learning and their name of college**

Name of college		N	Mean Rank	Kruskal-Wallis	Sig.
Behavioural engagement	College of Computer Science and Engineering	108	154.89	15.448	0.051
	College of Business administration	7	191.43		
	College of arts and Humanities	67	190.30		
	college of sceince	9	175.61		
	College of education	58	174.41		
	college of family sceince	2	117.75		
	College of applied Medical Science	63	214.20		
	college of law	18	178.50		
	other	27	191.22		
Cognitive engagement	College of Computer Science and Engineering	108	185.36	4.496	0.810
	College of Business administration	7	156.71		
	College of arts and Humanities	67	184.93		
	college of sceince	9	155.83		
	College of education	58	168.39		
	college of family sceince	2	91.50		
	College of applied Medical Science	63	176.50		
	college of law	18	200.69		
	other	27	186.31		
Emotional engagement	College of Computer Science and Engineering	108	164.37	11.766	0.162
	College of Business administration	7	142.29		
	College of arts and Humanities	67	172.32		
	college of sceince	9	147.11		
	College of education	58	199.41		
	college of family sceince	2	154.00		
	College of applied Medical Science	63	193.49		
	college of law	18	227.72		
	other	27	179.26		

Social engagement	College of Computer Science and Engineering	108	148.25	30.173	0.000
	College of Business administration	7	130.07		
	College of arts and Humanities	67	212.60		
	college of sceince	9	148.06		
	College of education	58	211.70		
	college of family sceince	2	108.25		
	College of applied Medical Science	63	167.37		
	college of law	18	222.19		
	other	27	188.30		

$\alpha = 0.05$

No significant difference in behavioural engagement because the sig. value of Kruskal-Wallis test (0.051) greater than 0.05, so we accept the null hypothesis which refer to no significant difference in behavioural engagement with level of confidence 95%. No significant difference in cognitive engagement because the sig. value of Kruskal-Wallis test (0.810) greater than 0.05, so we accept the null hypothesis which refer to no significant difference in cognitive engagement with level of confidence 95%. No significant difference in emotional engagement because the sig. value of Kruskal-Wallis test (0.162) greater than 0.05, so we accept the null hypothesis which refer to no significant difference in emotional engagement with level of confidence 95%. There was found a significant difference in social engagement because the sig. value of Kruskal-Wallis test (0.000) less than 0.05, so we reject the null hypothesis and accept the alternative one which refer to there was found a significant difference in social engagement with level of confidence 95%.

- **H3: there is a significant difference in students level of engagement in distance learning and their level of study**

Level of study		N	Mean Rank	Kruskal-Wallis	Sig.
Behavioural engagement	Diploma	5	196.30	1.889	0.389
	Bachelor	333	177.95		
	High studies	21	208.62		
Cognitive engagement	Diploma	5	152.30	0.471	0.790
	Bachelor	333	179.97		
	High studies	21	187.12		
Emotional engagement	Diploma	5	205.10	4.262	0.119
	Bachelor	333	176.90		
	High studies	21	223.19		
Social engagement	Diploma	5	200.80	12.719	0.002
	Bachelor	333	174.85		
	High studies	21	256.71		

$\alpha = 0.05$

No significant difference in **behavioural engagement** because the sig. value of Kruskal-Wallis test (0.389) greater than 0.05, so we accept the null hypothesis which refer to no significant difference in **behavioural engagement** with level of confidence 95%. No significant difference in **cognitive engagement** because the sig. value of Kruskal-Wallis test (0.790) greater than 0.05, so we accept the null hypothesis which refer to no significant difference in **cognitive engagement** with level of confidence 95%. No significant difference in **emotional engagement** because the sig. value of Kruskal-Wallis test (0.119) greater than 0.05, so we accept the null hypothesis which refer to no significant difference in **emotional engagement** with level of confidence 95%. There was found a significant difference in **social engagement** because the sig. value of Kruskal-Wallis test (0.002) less than 0.05, so we reject the null hypothesis and accept the alternative one which refer to there was found a significant difference in **social engagement** with level of confidence 95%.

RQ2: To what extent Saudi university students are actually engaged with the experience of distance learning based on (behavioural, cognitive, emotional and social) influences?

- **H4: distance learning has a positive effect in students' behavioural engagement**

Table No. () Responses of the participants about the extent of Saudi university students are actually engaged with the experience of distance learning based on behavioural, descending according to the Means of approval.

No.	Item	Strongly Disagree		Disagree		Neutral		Agree		Strongly Agree		Mean	Std. Deviation	Extent	Order
		Count	%	Count	%	Count	%	Count	%	Count	%				
1	I set aside a regular time each week to work on Blackboard.	11	3.1 %	29	8.1%	55	15.3 %	122	34.0 %	142	39.6 %	3.99	1.07	Agree	1
2	I took notes while studying the Blackboard.	12	3.3 %	45	12.5 %	45	12.5 %	125	34.8 %	132	36.8 %	3.89	1.13	Agree	2
3	I revisited my notes when preparing for Blackboard assessment tasks.	10	2.8 %	57	15.9 %	49	13.6 %	129	35.9 %	114	31.8 %	3.78	1.14	Agree	3
Behavioural engagement												3.8867	.95954	Agree	

In the previous Table it is clear that the participants agree with the behavioural engagement with an average of (3.88 from 5.00), an average that falls in the fourth category of fifth scale categories (from 3.4 to 4.2). It is clear that the participants agree on all features of behavioural engagement, which was arranged in descending order according to the approval of the participants as follows: The item No. (1), which is: " I set aside a regular time each week to work on Blackboard." come first in terms of approval of the participants with an average of (3.99 out of 5). The item No. (2) came: " I took notes while studying the Blackboard.", in the second place in terms of approval of the participants with an average of (3.89 out of 5). The item No. (3): " I revisited my notes when preparing for Blackboard assessment tasks." came third in terms of approval of the participants with an average of (3.78 out of 5), as indicated in the following figure:

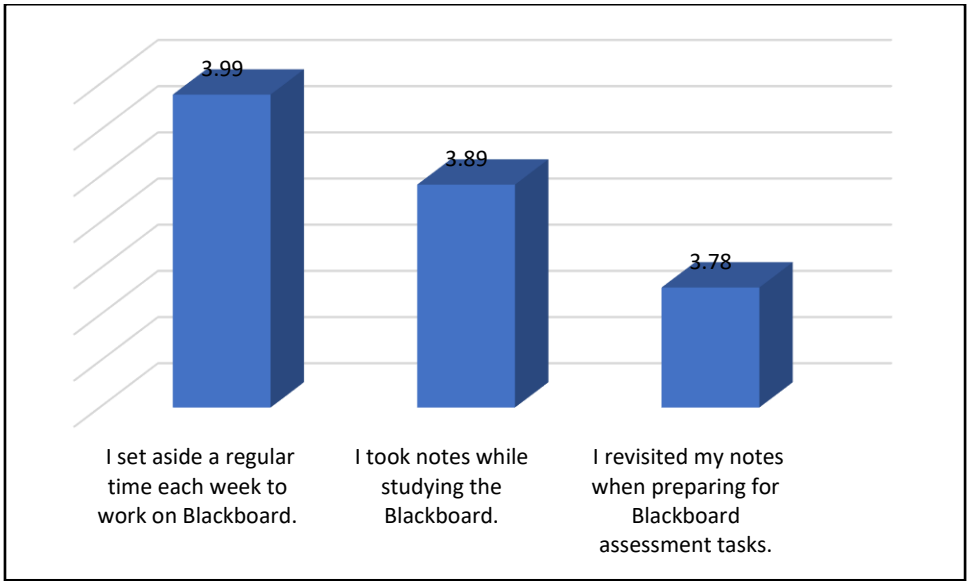


Figure No. () Responses of the participants about the extent of Saudi university students are actually engaged with the experience of distance education based on behavioural, descending according to the Means of approval.

- **H5: distance learning has a positive effect in students' cognitive engagement**

Table No. () Responses of the participants about the extent of Saudi university students are actually engaged with the experience of distance education based on congnitive, descending according to the Means of approval.

No.	Item	Strongly Disagree		Disagree		Neutral		Agree		Strongly Agree		Mean	Std. Deviation	Extent	Order
		Count	%	Count	%	Count	%	Count	%	Count	%				
1	I often searched for further information when I encountered something in the Blackboard that puzzled me.	6	1.7%	15	4.2%	27	7.5%	138	38.4%	173	48.2%	4.27	0.90	Strongly Agree	1
2	When I had trouble understanding a concept or an example, I went over it again until I under-stood it.	4	1.1%	17	4.7%	28	7.8%	148	41.2%	162	45.1%	4.25	0.87	Strongly Agree	2
3	If I watched a video lecture that I did not understand at first, I would watch it again to make sure I understood the content.	12	3.3%	33	9.2%	33	9.2%	91	25.3%	190	52.9%	4.15	1.13	Agree	3
congnitive engagement												4.2238	.74935	Strongly Agree	

In the previous Table it is clear that the participants strongly agree with the congnitive engagement with an average of (4.22 from 5.00), an average that falls in the fifth category of fifth scale categories (from 4.2 to 5). It is clear that the participants strongly agree on most features of congnitive engagement, which was arranged in descending order according to the approval of the participants as follows: The item No. (1), which is: " I often searched for further information when I encountered something in the Blackboard that puzzled me." come first in terms of approval of the participants with an average of (4.27 out of 5). The item No. (2) came: " When I had trouble understanding a concept or an example, I went over it again until I under- stood it..", in the second place in terms of approval of the participants with an average of (4.25 out of 5). The item No. (3): " If I watched a video lecture that I did not understand at first, I would watch it again to make sure I understood the content.." came third in terms of approval of the participants with an average of (4.15 out of 5), as indicated in the following figure:

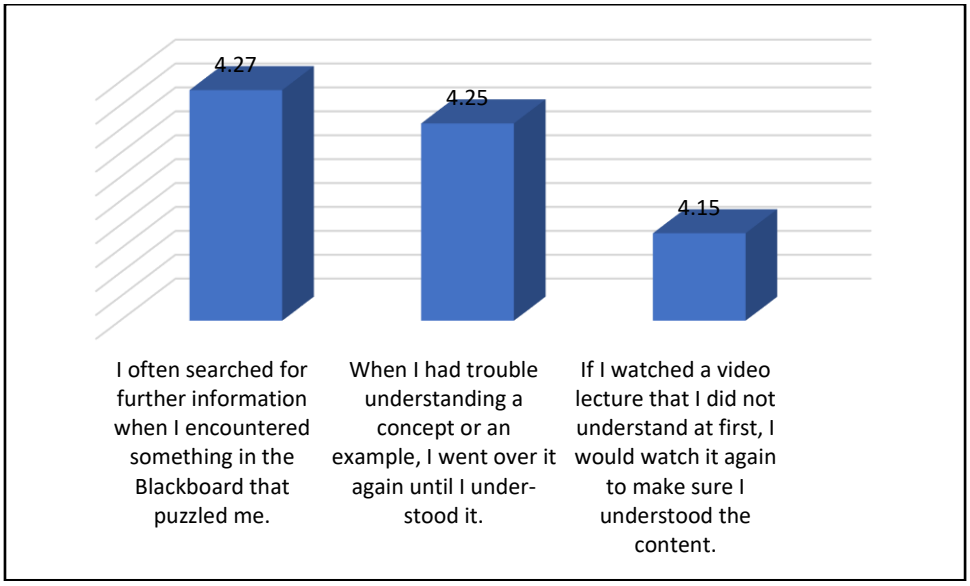


Figure No. () Responses of the participants about the extent of Saudi university students are actually engaged with the experience of distance learning based on congnitive, descending according to the Means of approval.

- **H6: distance learning has a positive effect in students' emotional engagement**

Table No. () Responses of the participants about the extent of Saudi university students are actually engaged with the experience of distance education based on emotional, descending according to the Means of approval.

No.	Item	Strongly Disagree		Disagree		Neutral		Agree		Strongly Agree		Mean	Std. Deviation	Extent	Order
		Count	%	Count	%	Count	%	Count	%	Count	%				
1	I was inspired to expand my knowledge in the Blackboard.	37	10.30%	55	15.30%	79	22.00%	106	29.50%	82	22.80%	3.39	1.27	Neutral	2
2	I found the Blackboard interesting.	51	14.20%	56	15.60%	60	16.70%	83	23.10%	109	30.40%	3.4	1.42	Neutral	1
3	I enjoyed watching video lectures in the Blackboard.	85	23.70%	68	18.90%	49	13.60%	49	13.60%	108	30.10%	3.08	1.57	Neutral	3
Emotional engagement												3.2888	1.24791	Neutral	

In the previous table it is clear that the participants Neutral with the emotional engagement with an average of (3.28 from 5.00), an average that falls in the third category of fifth scale categories (from 4.2 to 5). It is clear that the participants Neutral on most features of emotional engagement, which was arranged in descending order according to the approval of the participants as follows: The item No. (2), which is: " I found the Blackboard interesting." come first in terms of approval of the participants with an average of (3.4 out of 5). The item No. (1) came: " I was inspired to expand my knowledge in the Blackboard.", in the second place in terms of approval of the participants with an average of (3.39 out of 5). The item No. (3): " I enjoyed watching video lectures in the Blackboard." came third in terms of approval of the participants with an average of (3.08 out of 5), as indicated in the following figure:

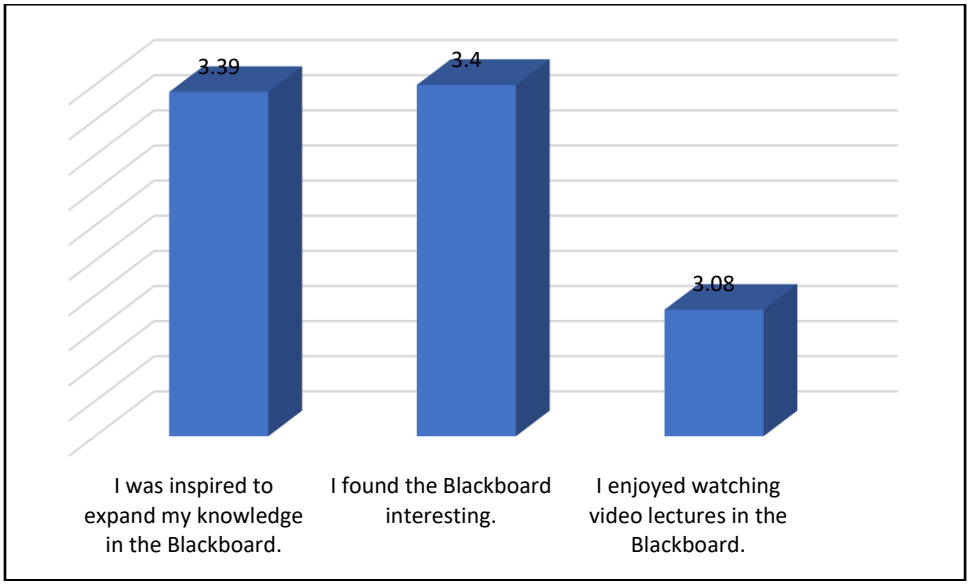


Figure No. () Responses of the participants about the extent of Saudi university students are actually engaged with the experience of distance education based on emotional, descending according to the Means of approval.

- **H7: distance learning has a positive effect in students' social engagement**

Table No. () Responses of the participants about the extent of Saudi university students are actually engaged with the experience of distance education based on social, descending according to the Means of approval.

No.	Item	Strongly Disagree		Disagree		Neutral		Agree		Strongly Agree		Mean	Std. Deviation	Extent	Order
		Count	%	Count	%	Count	%	Count	%	Count	%				
1	I often responded to other learners' questions.	20	5.6%	48	13.4%	75	20.9 %	144	40.1%	72	20.1%	3.56	1.12	Agree	2
2	I contributed regularly to course discussions.	30	8.4%	46	12.8%	72	20.1 %	114	31.8%	97	27.0%	3.56	1.24	Agree	3
3	I shared learning materials (eg, notes, multimedia, links) with other classmates in the Blackboard.	16	4.5%	25	7.0%	49	13.6 %	141	39.3%	128	35.7%	3.95	1.08	Agree	1
Social engagement												3.6890	.95433	Agree	

In the previous table it is clear that the participants agree with the social engagement with an average of (3.68 from 5.00), an average that falls in the fourth category of fifth scale categories (from 4.2 to 5). It is clear that the participants agree on most features of social engagement, which was arranged in descending order according to the approval of the participants as follows:

The item No. (3), which is: " I shared learning materials (eg, notes, multimedia, links) with other classmates in the Blackboard." come first in terms of approval of the participants with an average of (3.95 out of 5). The item No. (1) came: " I often responded to other learners' questions.", in the second place in terms of approval of the participants with an average of (3.56 out of 5). The item No. (2): " I contributed regularly to course discussions." came third in terms of approval of the participants with an average of (3.56 out of 5), as indicated in the following figure:

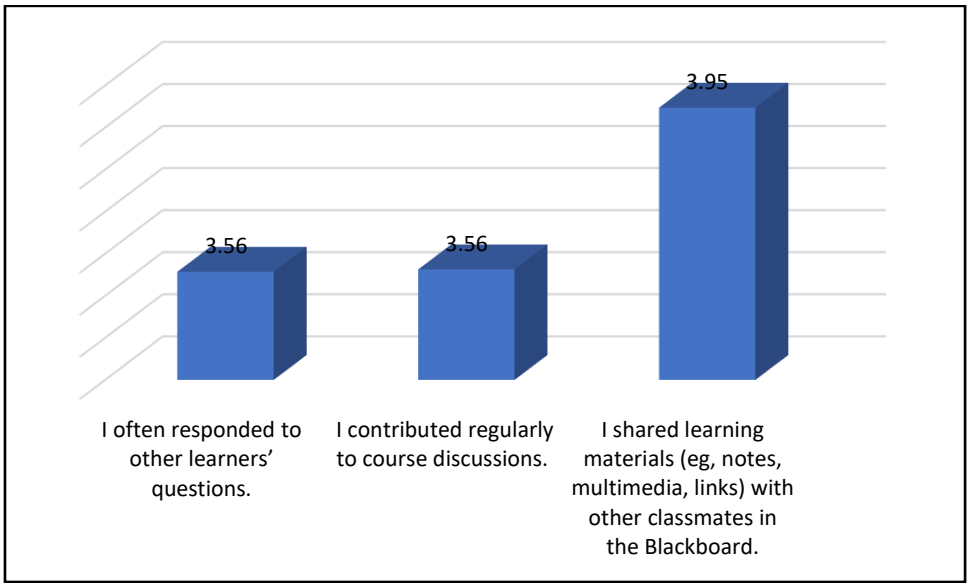


Figure No. () Responses of the participants about the extent of Saudi university students are actually engaged with the experience of distance learning based on social, descending according to the Means of approval.

Discussion

RQ1: what determents Saudi university students' (Behavioural, cognitive, emotional and social) engagement in distance learning based on their demographic characteristics?

The main observable trend within the findings tied social engagement domain as the main indicator with a significant difference cross all categories of gender, subject of study and level of education. Whereas other engagement domains (behavioral, cognitive, emotional) showed slight differences based on demographic variables. Regarding gender female students showed higher level of social engagement than in their male fellow students. In line with previous studies showing Female socially more engaged than male in distance learning, (Nistor, 2013) asserts that males were more stable in attitudes, while females performed well in engagement. (Alghamdi, Karpinski, Lepp, & Barkley, 2020) study conclude that gender differences in overall engagement of distance learning have led to more positive online learning outcomes of females than males due to the females' stronger self-regulation than males. It is evident that students were able to build self-learning strategies that would enables behavior, cognitive and emotional engagement, however, they were not able to approach social one. Hence, indicating that social engagement has a huge consequence on students' level of general engagement leads to the importance of developing students' social experience on distance education. This finding aligns with (Altuwairesh, 2021) (Alawajee, 2021) studies indicates students' negatively experienced low-interaction and communication level in distance learning. In line with (Alawajee, 2021) findings which indicates distance learning supports students learning process by becoming more like self-educated and self-learner, thus, becoming more independent learners. Such absence of face-to-face interaction hinder students' motivation in distance learning, in which both above-mentioned studies suggested that building positive students-instructors, students-students, and students-content interactions is a vital requirement for distance learning improvement. Distance learning platforms offer many social interactions opportunities synchronously and asynchronously, such as video conferencing, online forum discussions and much more. In which communities can be constructed, sense of belonging can be shaped, relationships can be developed, and trust can be established within a safe environment. However, this study findings stated that these opportunities found to be challenging to put into practice which might be related to the fact that distance learning in Saudi higher education grew suddenly with lack of groundwork (Aladsani, 2021). (Venton & Pompano, 2021) study reveals that student's level of engagement is greater in distance class where active learning is a central component of instruction. Unquestionably, promoting student engagement is heavily associated with the instructor's role and this role is a continues one throughout the course duration and it could be taking a place in different forms such as guide, feedback, learning activities (Yu et al., 2020).

RQ2: To what extent Saudi university students are actually engaged with the experience of distance learning based on (Behavioural, cognitive, emotional and social) influences?

The second research question attempted to explore the following: To what extent Saudi university students are actually engaged with the experience of distance learning based on (Behavioural, cognitive, emotional and social)

influences? In response to this question, students expressed positive agreement about behavioural, cognitive, emotional, and social engagements in distance learning. The result showed that the students enjoyed the experience of distance learning. The findings are in line with the previous studies reported by (Al-Nofaie, 2020) (Bahanshal & Khan, 2021) (Alshahrani, 2021) (Ta'amneh, 2021) who found that the students had positive attitudes towards E-learning and they were prepared to shift to online mode. It is important to note that, Taibah University has been using the Blackboard system as eLearning tool since 2008 (Taibah University, n.d.). This indicate that faculty members and the students were ready to adopt the Distance learning during the COVID-19 crisis and the finding of this study are not surprising. Therefore, it seems that the participants enjoyed and engaged in distance learning during the COVID-19 pandemic due to existence of eLearning tools and prior experience. The participants in this study agreed on all features of behavioral engagement and strongly agreed on most features of cognitive engagement. The participants expressed Neutral on most features of emotional engagement and agreed on most features of social engagement.

The result showed that the highest engagement that students agreed with was the cognitive engagement. This indicate that students could take more responsibility for their own learning in distance environments. Also, students could have Self-regulation learning strategies that enabled them to succeed in their online classes as (Park & Yun, 2018) mentioned in their study. The study also showed that the second engagement that students had were behavioral engagement and social engagement which showed that the students are able to participate and contract their own knowledge, share their thoughts, and participate in online discussion. This finding is in line with previous study reported by (Tang & Hew, 2022) who found that the distance learning promotes reflection and interaction. Moreover, Students expressed Neutral when asked about their emotional engagement with the experience of adopting distance learning. This revealed that the students were incretin and maybe they were stress due to the first experience of fully incorporating the distance learning and they could be worried about their grades and tests. This finding is in line with previous study reported by (Mahyoob, 2020) who found that students were not satisfied with distance learning due to many obstacles including testing.

Conclusion

Due to COVID-19 crisis our life has changed including the way we teach and learn. Integrating Distance learning has had both positive and negative impacts on students. In order to understand how students engaged in this new environment, this study has attempted to investigate how students are engaged with the experience of distance education based on behavioural, cognitive, emotional, and social influences. The result showed that fully implementing distance learning at Taibah University was effective and successful solution for the students during the COVID-19 crisis. Distance learning may face different challenges, but it has the potential to replace traditional classrooms in the future. The finding of the study showed four different students' engagements towards the distance learning during the COVID-19 period. The finding indicated that there was significant different between students' social engagement. The study also revealed that students had the lowest emotional engagement.

Therefore, the distance learning is bound to succeed if the stakeholders take the necessary steps. Institutions need to invest more in distance learning platform to ensure all students can access this platform. It is also important to conduct a needs assessment for students and faculty members during remote and hybrid learning to provide resources during these challenging times of anxiety and uncertainty. The role of instructors is to create purposeful course designs that increase students' interaction and engagements. Faculty members should be advised on the way to incorporate new teaching and assessment experience to engage students during the online courses. It is essential for instructors to listen to students' concerns and offer them the opportunity to have a one-to-one conversation to reconnect and discuss any distresses that might have arisen during the adoption of distance learning. Extensive training must be provided to instructors to equipped them with the know-how necessities to enhance students' social engagement in distance education. Especially in how to incorporate social learning theories into the design of online courses that would enables the active learning. It recommended that the four level of engagement to be part of the instructional design.

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Guidelines for Preparing for, Designing, and Implementing Peer Assessment in Online Courses

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Abstract
Peer assessment (PA) is widely implemented in higher education, and it can play an important role in online learning by connecting students to their peers and enabling feedback from multiple sources. However, high-quality feedback is not guaranteed. And students tend not to use peer feedback. Preparing for, designing, and implementing PA can be challenging for instructors, especially those who are relatively new to online teaching. This paper proposes guidelines for preparing for, designing, and implementing PA based on a review of empirical studies. The paper first reviews the benefits of PA, the important role that PA can play in online courses, and the need for effective preparation, design, and implementation of PA activities in online courses. Afterwards, based on a review of empirical studies that aim to improve the effectiveness of technology-facilitated PA interventions, the paper proposes guidelines for PA activities.
Keywords: peer assessment, peer assessment guidelines, online courses, higher education

INTRODUCTION

Peer assessment (PA) activities are widely used in higher education. PA can include grading and/or providing comments. Students who assess peers' work can be referred to as assessors, and those whose work is assessed are assessees. In most cases, students play both roles. PA has been implemented in various types of courses in higher education, such as dance education (Hsia et al., 2016), introductory physics (Y. H. Cho & Cho, 2011), instructional design (Fang et al., 2021), nursing education (H.-C. Lin et al., 2021), clinical epidemiology (Filius et al., 2018), and computer engineering programming (a calculus and numerical methods course) (Rico-Juan et al., 2021). Interest in PA is also indicated by the number of meta-analyses in recent years (e.g., Chang et al., 2021; H. Li et al., 2020; Panadero & Alqassab, 2019; Tenório et al., 2016; Zhan et al., 2022; Zheng et al., 2020).

The potential benefits of PA reside in two aspects: providing and receiving feedback (Van der Pol et al., 2008). However, high-quality peer feedback is not guaranteed, and students tend not to use feedback, especially in online courses. These issues prevent students from reaping the benefits of PA. In an era when online education is ubiquitous, designing and implementing PA activities can be challenging for instructors, especially those who are relatively new to online teaching. This paper proposes guidelines to help instructors prepare for, design, and implement PA. The guidelines are grounded in a review of research articles that aim to improve the effectiveness of PA.

LITERATURE REVIEW

BENEFITS OF PA

Students can benefit from PA in several ways. First of all, assessors can learn during PA, and thus improve their own work. Specifically, they can develop a better understanding of the project requirements, scoring criteria, and the topic (Y. H. Cho & Cho, 2011; Hsia et al., 2016; Noroozi et al., 2016); generate more ideas (Hsia et al., 2016); learn from their peers' work (Hsia et al., 2016), and critically reflect on their own work (Ertmer et al., 2007; Fang et al., 2021). Ertmer et al. (2007) argued that "perhaps the greatest potential benefit of the peer feedback process lies in the constructive aspect of forming and justifying peer feedback." (p. 428). Cho & Cho (2011) found that providing comments on weaknesses at the micro level (i.e., the content of one paragraph) and comments on strengths at the macro level (i.e., the content across several paragraphs) of peers' laboratory reports positively affected the quality of assessors' own revised reports. Similarly, Li et al. (2010) found a positive correlation between the quality of the feedback students constructed and the scores of their final projects. Van der Pol et al. (2008) concluded that as long as students expend effort to review their peers' work and compose feedback, learning benefits can be expected.

As assessees whose work is evaluated by peers, students can receive feedback that can contribute to the improvement of their performance (Hsia et al., 2016). The benefits of receiving peer feedback, to a large extent,

hinge upon the usefulness of the feedback and, more importantly, on how students use the feedback. And the use of feedback significantly affects the quality of students' final projects (L. Li et al., 2012).

However, students are not experts in the content area. Some feedback may be incorrect or misleading. Sometimes comments from multiple assessors are contradictory, which can confuse assessees (Mostert & Snowball, 2013). Also, students do not consider their peers a "knowledge authority" (S. Gielen et al., 2010, p. 305) and are skeptical of their peers' ability to provide feedback. This skepticism can have both positive and negative impacts on assessees. Specifically, the skepticism may result in reluctance to take peer assessors' advice or resistance to peer feedback. For example, Kim (2005) found no correlation between peer feedback scores and students' performance and attitudes toward peer feedback. The author speculated that assessees did not trust their peers' ability to provide feedback, which prevented them from internalizing the feedback. However, on the other hand, a skeptical attitude may lead assessees to develop their own ideas for improvement. In Gielen et al's (2010) study, students initiated more self-correction when they received peer feedback than when receiving feedback from the instructor. Video recordings of the interactions between students during PA along with interview data showed that students "doubted" peer feedback, which led to the development of their own ideas to improve their essays.

PA AND ONLINE LEARNING

The COVID-19 pandemic made online teaching and learning compulsory for instructors and students in higher education. Therefore, "it is no longer a question of whether online education can deliver the promise of a quality higher education and rather one of how can universities immediately and effectively embrace mass adoption of online learning" (Liguori & Winkler, 2020, p. 347). PA, a form of collaborative learning, could play a more important role in online classes than in face-to-face classes. First, through PA, students receive feedback from peers, which has the potential to improve students' satisfaction with online courses because a lack of feedback leads to attrition from online courses (Ertmer et al., 2007). In online courses, feedback "is one of the few processes that connects individual learners to instructor and peers" (Jensen et al., 2021, p. 1). PA can increase the interactions between students (Van der Pol et al., 2008) and build the connections between students and their peers. Martin et al. (2019) investigated exemplary online teaching practices by interviewing eight instructors who had received teaching awards from three large online teaching and learning organizations (The Online Learning Consortium, Association for Educational Communications and Technology, and United States Distance Learning Association). All interviewees reported that a learning community is key to successful online learning, and one of the strategies to create a learning community is to use PA activities, the other two being online discussion and group projects.

NEED FOR EFFECTIVE PREPARATION, DESIGN, AND IMPLEMENTATION OF PA ACTIVITIES IN ONLINE COURSES

Acting upon feedback, or "a successful uptake" of feedback, is critical (Van der Pol et al., 2008, p. 1805). Students' willingness to act upon feedback largely hinges upon the quality of the feedback, which is not guaranteed. First, many college students do not have PA skills, including understanding the evaluation criteria, judging peers' performances, and composing constructive feedback. Second, not all students put a lot of effort into providing quality feedback. In a study by Mostert & Snowball (2013), economics students in a large-enrollment class assessed their peers' essays. About half (47%) of the students reported that the PA activity was not useful, among which 29% indicated that their peers' engagement in PA was superficial, which was evidenced by the following student's comment: "People didn't even bother reading the essays they just commented on what they expected to be in there. How do you explain saying I have a good diagram when there is no diagram?" (p. 681) In the same study, students also reported that they expended efforts to create constructive feedback, but the feedback they received did not reflect their own efforts (Mostert & Snowball, 2013). When assessees do not receive high-quality feedback, they do not consider PA worthwhile, and they may lose the motivation to invest time and energy to compose constructive comments. This may be particularly true in a class where multiple cycles of PA are conducted. Third, the psychological and social barriers to PA (i.e., considering critiques as personal attacks) may lead to friendship marking or surface-level feedback (Noroozi et al., 2016; van Gennip et al., 2010).

Even when high-quality peer feedback is provided, students will not benefit from it if they do not use the feedback. For example, Kim (2005) found no correlation between peer feedback scores and students' performance. The author speculated that assesees did not trust their peers' ability to provide feedback, which prevented them from internalizing the feedback. This lack of internalization made it impossible for the assessees to reap the benefits of receiving peer feedback.

Online students tend not to engage in feedback provided by instructors. Mensink and King (2020) used data mining to analyze feedback files stored in a learning management system. The study revealed that 38% of the files were never opened by students. This percentage was even higher (42%) when students were allowed to see their grades without having to downloading the files. The account from a student in Winstone et al.'s study (2021) seems to

provide a vivid description of how online students used feedback: "Check the grade, log out." One of the main reasons for students' lack of engagement in feedback in these two studies is how feedback was delivered: students could access their grades without having to open the feedback files. In Mensink and King's study (2020), when grades were revealed in the feedback files instead of being separately posted on the learning management systems, the percentage of unopened feedback files decreased substantially to 17%. If students do not engage in online feedback provided by instructors, it is very unlikely that they will be more engaged in peer feedback.

METHODS

LITERATURE SEARCH

In this paper, guidelines for PA are proposed based on a review of the empirical studies published since 2010 because, in the early 2010s, conceptualization of feedback shifted from something delivered to students to a process in which students played an active role. For example, Shute (2008) conceptualized feedback as "information communicated to the learner" in her review of feedback studies (p. 154), and Hattie and Timperley (2007) defined feedback as "information provided by an agent" (p. 81). Later, feedback was viewed as a process that facilitates student learning and that requires students to play an active role (Boud & Molloy, 2013). Hattie and Gan (2011) emphasized that "feedback needs to move from a predominantly transmissive and verification process to a dialogic and elaborative process in a social context" (p. 257).

Articles were located in specific technology-facilitated learning journals, as suggested by Hwang & Tsai (2011) and Fu et al (2019). These journals included *British Journal of Educational Technology*, *Computers and Education*, *Educational Technology & Society*, *Educational Technology Research and Development*, *Interactive Learning Environments*, *Journal of Computer Assisted Learning*, and *Innovations in Education and Teaching International*. Given the nature of this topic, literature was also searched in other educational journals, including *Journal of Educational Computing Research*, *The Internet and Higher Education*, *Computers in Human Behavior*, *Assessment and Evaluation in Higher Education*, *Learning and Instruction*, and *Instructional Science*. Search terms included *peer assessment*, *peer evaluation*, *peer review*, *peer feedback*, and *peer comment*.

The criteria for inclusion were the following: (a) the article was published after 2010, (b) the study was empirical and conducted in higher education, (c) the PA activity was performed in online classes or was facilitated by technology, and (d) the purpose of the intervention was to improve the effectiveness of PA. A total of 30 articles were reviewed. See the list of articles in Table 1.

GUIDELINES

Three sets of guidelines are proposed for preparing for, designing, and implementing PA activities. I will explain each guideline and describe the empirical studies that it is built on. Table 1 lists the guidelines, the empirical studies supporting each guideline, and the major findings of those studies.

GUIDELINE 1 (PREPARATION): PROVIDE PA TRAINING TO PREPARE FOR PA

PA training is necessary to help students develop a positive attitude toward PA and enhance their willingness to use peer feedback as students do not consider themselves (Orsmond & Merry, 1996) or their peers (van Gennip et al., 2010) qualified to conduct PA. Furthermore, successful PA interventions hinge upon students' ability to conduct PA (Liu & Li, 2014). Van Zundert et al's (2010) review of the empirical studies published between 1990 and 2007 in educational research journals showed that PA training positively affected students' attitudes towards PA and improved the reliability and validity of PA. Empirical studies also reveal that students found that PA training was valuable (Filius et al., 2018), that PA training increased the accuracy of student ratings (Liu & Li, 2014) and the quality of students' work (Liu et al., 2018).

To help students understand evaluation criteria, identify the strengths and weaknesses of peers' work, and provide feedback, online instructors can use training strategies that include (a)

Table 1: *Guidelines, the Empirical Studies Each Guideline is Grounded upon, and the Empirical Study Findings*

Guideline	Rationale	
	List of empirical studies supporting the guideline	Major findings of the studies
Guideline 1. (preparation):	Filius et al., 2018; Liu &	In Filius et al.'s (2018) study, the PA intervention for an online course consisted of three steps: a) PA training; b) feedback and

Provide PA training to prepare for PA	Li, 2014; Liu et al., 2018; Van Steendam et al., 2010	rating, and c) optional feedback discussion. For the training, students were provided with text and a video that explained how to provide peer feedback that could enhance assessees' deep learning, along with good examples of peer feedback that could facilitate deep learning as well as bad examples. Students reported during the interview that the PA training was valuable. In another study (Liu & Li, 2014), the PA training consisted of helping students understand the rubric and having students grade example projects. Specifically, students watched a video highlighting the major evaluation criteria in the rubric and engaged in the whole-class discussion on key terms in the rubric. Students then assessed two example WebQuest projects created by previous students and compared their assessments with the instructor's, and the whole class had a discussion on the evaluation of the two projects. The study found that the training decreased the discrepancy between the student and instructor ratings, and the smaller the discrepancy, the higher the peer feedback quality. In Liu et al. (2018), the PA training took the form of business students' synchronous group discussions on the grading of a poor counter-offer letter and an excellent one in online chat rooms. The training improved the quality of students' counter-offer letters. In Van Steendam et al. (2010), students received one of two types of instruction: observation and practice. In the observation condition, students individually watched a video of two experts interactively modeling how to use the revision strategy provided to revise a letter. In the practice condition, students worked in pairs to practice revising a letter by using the revision strategy, after which they were provided a model answer. After the instruction, students were assigned to one of the two emulation conditions, individual emulation and dyad emulation, to practice composing feedback by using the criteria provided by the instructor. The study found that observational learning and practice were equally effective if the following emulation was individual, and that observational learning was more effective than practice if the following emulation was collaborative.
Guideline 2.1. (PA design): Consider the impact of group formation on PA	Author, 2018; Cho & MacArthur 2010; Papadopoulos et al., 2012	Author (2018) provided the experimental group with autonomy support by providing a rationale for PA, allowing students to choose two of the three evaluation criteria to focus on, acknowledging negative feelings, and using non-controlling language. The control and experimental groups did not differ in their engagement in PA and academic performance, but the experimental group reported a higher level of autonomy and spent more time on each evaluation criterion than the control group. Cho & MacArthur (2010) found that feedback provided by multiple peers led to more complex repair revisions (i.e., deleting points or revising existing points at the micro level) and revisions that added elaborations than feedback from a single expert or peer. Complex repair revisions predicted writing quality. In Papadopoulos et al. (2012), students in the free-selection group could access all peers' answers to open-ended scenarios. They could read as many answers as they wanted to and then selected three to review. The study found that, compared with the students who were randomly paired for review, students in the free-selection group acquired more domain conceptual knowledge and showed higher PA skills.

Guideline 2.2. (PA design): Consider the pros and cons of anonymity	Güler, 2017; Howard et al., 2010; Li, 2017; Lin, 2018; van den Bos & Tan, 2019	In Güler (2017), the survey results showed that anonymity did not affect students' perceived fairness of PA. However, student interviews suggested that most of the students who were concerned about the fairness of PA were in the non-anonymous group. The peer ratings made by the anonymous group were more correlated with the instructor ratings. Howard et al. (2010) revealed that, students in the non-identified group were about five times more likely to create critical feedback and four times more likely to provide justifications for the improvements they suggested than those who were known to their peers. In Li (2017), students were placed in one of the three groups: the Identify Group, in which students' identities were known to their peers; the Anonymity Group in which students' identities were not revealed, and the Training Group in which students received training on the purpose and benefits of PA and the strategy used in the study to address their concerns related to being identifiable. The study found that the Identity Group's final project scores were the lowest. The Training Group had a higher perception of the usefulness of PA and a lower perception of pressure than either the Identity Group or the Anonymity Group. Lin (2018) found that students in the anonymous group reported more learning from PA than their counterparts. The former had a more positive attitude toward the PA system and a lower level of perceived fairness of peer comments than the latter. In van den Bos & Tan (2019), the anonymous group provided significantly more higher-order feedback (feedback on ideas, organization, argumentation, etc.), generated less feedback on directive lower-order concerns, processed more directive higher-order feedback, and obtained higher scores on their revised essays, compared with the non-anonymous group.
Guideline 2.3. (PA design): Combine peer grading and peer comments to maximize student learning, and encourage assessors to address both strengths and weaknesses and provide sufficient explanations	Cho & Cho, 2011; Fang et al., 2021; Hsia et al, 2016; Huisman et al., 2018; Noroozi et al., 2016	Cho & Cho (2011) found that providing strength comments at the macro level (i.e., the content of writing across several paragraphs) and weakness comments at the micro level (i.e., the content of writing in one paragraph) on peers' laboratory reports positively influenced the quality of the assessors' own revised reports. Fang et al (2021) found that the experimental group, in which pre-service teachers collaboratively rated and provided comments on another group's video, created videos of higher quality and showed higher self-efficacy in successfully completing the course and critical thinking skills than the control group who only rated their peers' videos. Huisman et al. (2018) found that feedback justifications were positively correlated with perceived adequacy of peer feedback and willingness to use peer feedback. Hsia et al (2016) put students in one of the three groups when they reviewed peers' group dance performance videos: (a) peer grading, (b) peer feedback, and (c) mixed mode (grading + feedback). They found that the mixed group showed the best performance by providing more detailed feedback, giving scores more correlated with the instructor's scores, and participating in the PA activity more frequently.

		Noroozi et al. (2016) examined the impact of a peer feedback script on the quality of students' argumentative essays and how the PA process affected the quality of students' essays. The peer feedback script consisted of questions to guide the provision of feedback on argumentative essays and what should be incorporated in essays. The study found that the script improved the quality of students' argumentative essays and that students who provided and received more constructive and justified feedback scored higher on the argumentative essays.
Guideline 2.4. (PA design): Use strategies to actively engage assessees in PA	Filius et al., 2018; M. Gielen & De Wever, 2015; Kim & Ryu, 2013; Lin et al., 2021, Yang, 2011	In Filius et al. (2018), assessees had dialogues with assessors. Additionally, assesses rated the feedback they received. Assessees reported during interviews that having to rate peer feedback forced them to read the feedback in detail and look critically at their own work. M. Gielen & De Wever (2015c) examined the impacts of (a) a peer feedback request form that asked assessees to list the feedback they needed on the abstract they wrote, (b) a content checklist form that asked assessors to check the essential components of an abstract, and (c) a peer feedback template on students' peer feedback quality and final abstracts. The peer feedback template included four sections: (a) a list of the criteria that could be used to assess the abstracts peers wrote, (b) a section to leave peer feedback, (c) a section to make suggestions for improvement, and (d) a section for the writer of the abstract to evaluate the quality of the peer feedback given to them. The study found that peer feedback requests significantly improved the quality of peer feedback over time. The peer feedback template positively affected the quality of students' final products. Kim & Ryu (2013) created a web-based PA system that could provide students with meta-cognitive scaffolding and that allowed assessors and assessees to discuss the peer feedback. The study found that the system promoted students' metacognitive awareness, academic performance, and motivation in conducting PA. In Lin et al. (2021), the experimental group individually rated three peers' physical examination skill practices and gave feedback to their peers. Assessees evaluated whether assessors' ratings were reasonable and commented on the peer feedback they received. The intervention improved students' performance on the post-learning achievement test, as well as their physical examination skill, critical thinking tendency, and reflective skill. In a study by Yang (2011), assessees evaluated assessors' comments on their essays and responded to the comments (e.g., "Thank you for the suggestion. I'll revise it.") (p. 691).
Guideline 2.5 (PA design): Encourage interactions between students	Filius et al., 2018; Yu, 2011; Zheng et al., 2018	In Filius et al.'s (2018) study, after online students went through PA training and completed the PA activity, assessors and assessees discussed peer feedback in a discussion forum, but the discussion was optional. Students reported that they made little use of feedback discussion. Interview results suggested two reasons: the discussion was optional and having to navigate to another virtual location to discuss feedback made students less motivated to engage in the discussion. In Yu (2011), pre-service teachers conducted PA in one of three modes: one-way, two-way, and multi-way. In the two-way mode, assessors and assessees could have conversations on the peer ratings and feedback. In the multi-way mode, online conversations took place between assessors and assessees as well as among multiple

		assessors. The survey results showed that pre-service teachers liked the multi-way mode best, and they liked the two-way mode better than the one-way mode. Zheng et al. (2018) found that the experimental group who had online synchronous discussions on peer feedback outperformed the control group in writing performance, peer feedback quality, metacognitive awareness, and self-efficacy in PA.
Guideline 3. (implementation): Provide structure and use technologies to help ensure a smooth implementation of PA	Çiftçi & Koçoğlu, 2012; Güler, 2017; M. Gielen & De Wever, 2015a; M. Gielen & De Wever, 2015b; M. Gielen & De Wever, 2015c; Mostert & Snowball, 2013; Noroozi et al., 2016; Novakovich, 2016; Novakovich & Long, 2013; Papadopoulos et al., 2012; Samaie et al., 2018; van Den Bos & Tan, 2019; Yang 2011	Çiftçi & Koçoğlu (2012) found that the group that had blog-mediated PA scored higher on their revised drafts than did the group that conducted face-to-face PA. Güler (2017) found that the personal messaging function of WhatsApp could make PA anonymous. M. Gielen & De Wever (2015a) used peer feedback templates with varying degrees of structure (no structure, basic structure, and elaborated structure). The non-structure group was provided with a list of assessment criteria. The basic-structure group was provided with assessment criteria and two guiding questions ("What do you like about your peers' work and "What would you change in your peers' work?"). The elaborated-structure group received a template created based on the principles of feed up (i.e., state the goal), feedback (i.e., assess how peers did), and feed forward (i.e., offer suggestions for improvement). This group needed to formulate the feed up, feedback, and feed forward for each of the ten criteria. One of the major study findings was that the basic structure led to more feedback elaborations, but the elaborated structure did not. M. Gielen & De Wever (2015b) used the same template with varying degrees of structure (no structure, basic structure, and elaborated structure) as in M. Gielen & De Wever (2015a). M. Gielen & De Wever (2015b) examined the impacts of the templates on feedback and product quality. They found that the elaborate structure led to feedback of higher quality than no structure did. The elaborate and basic structures led to higher product scores than no structure did. M. Gielen & De Wever (2015c) examined the impacts of (a) a peer feedback request form that asked assessees to list the feedback they needed on the abstract they wrote, (b) a content checklist form that asked assessors to check the essential components of an abstract, and (c) a peer feedback template on students' peer feedback quality and final abstracts. The peer feedback template included four sections: (a) a list of the criteria that could be used to assess the abstracts peers wrote, (b) a section to leave peer feedback, (c) a section to make suggestions for improvement, and (d) a section for the writer to evaluate the quality of the feedback given to them. The study found that peer feedback requests significantly improved the quality of peer feedback over time. The peer feedback template positively affected the quality of students' final products. Mostert & Snowball (2013) used Moodle for anonymous PA in a large-enrollment economics class. Noroozi et al. (2016) examined the impact of a peer feedback script on the quality of students' argumentative essays and how the PA process affected the quality of students' essays. The peer feedback script consisted of questions to guide the provision of feedback on two peers' argumentative essays and a list of elements that should be included in high-quality argumentative essays. The study found that

	the peer feedback script improved the quality of students' argumentative essays and that students who provided and received more constructive and justified feedback scored higher on the argumentative essays.
	Novakovich (2016) and Novakovich & Long (2013) used blogs for PA.
	Papadopoulos et al. (2012) provided students with review guidelines that consisted of three questions to direct students' attention to the content, argumentation, and expression of their peers' answers to open-ended scenarios.
	Samaie et al., 2018 used WhatsApp for self-assessment and PA.
	The PA system Yang (2011) created provided definitions and examples of local and global errors for students who assessed their peers' essays.
	van Den Bos & Tan (2019) used the free online program called Peergrade for PA.

providing videos, presentations, or text-based materials that explain the evaluation rubric and how to conduct PA, (b) providing good and bad evaluation examples, and (c) asking students to discuss the gradings of sample work or practice assessing sample work. For example, in Filius et al.'s (2018) study, researchers aimed to use PA to improve students' deep learning. For the training, students were provided with text and a video that explained how to provide peer feedback that could enhance assessees' deep learning. They were also provided with good examples of peer feedback that could contribute to deep learning as well as bad examples. Aiming to provide interactive training, Liu et al. (2018) had students discuss the grading of a poorly written and a well-written writing sample in small groups in online chat rooms. In another study (Liu & Li, 2014), the PA training consisted of helping students understand a rubric and having students grade example projects. Specifically, students watched a video highlighting the major evaluation criteria in the rubric and engaged in a whole-class discussion of key terms in the rubric. They then assessed two example WebQuest projects created by previous students and compared their assessments with the instructor's. Similarly, Van Steendam et al. (2010) asked students to individually or collaboratively practice composing feedback on peers' writings, following the revision strategy instruction.

GUIDELINE 2.1 (PA DESIGN): CONSIDER THE IMPACT OF GROUP FORMATION ON PA

Feedback from multiple peers seems to be more beneficial than feedback from a single peer, so assigning more than two students to a group is recommended. Cho & MacAuthur (2010) found that feedback from multiple peers led to more complex repair revisions (i.e., deleting points or revising existing points at the micro level) and more revisions that added elaborations than feedback from a single expert or peer. In addition, even when instructor feedback is provided, having students provide and receive peer feedback can contribute to student learning, as suggested by Tai et al. (2015), who found that the experimental group that received instructor and peer feedback outperformed the control group that only received instructor feedback in the final drafts of their writing. If technologies allow, instructors can ask students to freely select which work to review, or which evaluation criteria to focus on. In Papadopoulos et al. (2012), students in the free-selection group could access all peers' answers to the open-ended scenarios and freely select three peers' work to review. The study found that, compared with the students who were randomly paired for review, the free-selection group acquired more domain conceptual knowledge and showed higher PA skills. In Author (2018), students who were allowed to choose two of the three evaluation criteria to focus on when providing feedback on their peers' essays spent more time on each evaluation criterion than those in the control group did.

GUIDELINE 2.2 (PA DESIGN): CONSIDER THE PROS AND CONS OF ANONYMITY

PA is a social activity that involves at least two students. It can be affected by "friendship bonds, enmity or other power processes, group popularity levels of individuals, perception of criticism as socially uncomfortable or even socially rejecting and inviting reciprocation, or collusion leading to lack of differentiation" (Topping, 2003, p. 67). As a result, students do not feel comfortable criticizing their peers' and, in particular, their friends' work (Dochy et al., 1999; Sluijsmans et al., 2002). This is evidenced by students in Samaie et al's study (2018) where students used WhatsApp to assess their peers' and their own audio recordings. One student commented, ". . . if I give a bad mark to some classmates, it will make them sad. Mobile peer-assessment is not reliable due to friendship among students." (p. 118)

Anonymity can alleviate peer pressure (Vanderhoven et al., 2015), decrease the uneasiness stemming from the reluctance to provide negative comments (van den Bos & Tan, 2019), and lead to honest comments (Guardado & Shi, 2007). For example, Howard et al (2010) found that students in an anonymous group were five times more likely to provide critical feedback than students in an identifiable group.

Anonymity can also have a positive impact on assessees' use of peer feedback. Students tend to be reluctant to use the feedback provided by less-capable peers even when the feedback is correct (R. Lu & Bol, 2007; van den Bos & Tan, 2019). Without knowing the peer's status and past academic performance, students may be more likely to engage in deep and critical thinking before deciding to accept or reject the feedback (van den Bos & Tan, 2019). The study by van den Bos & Tan (2019) revealed that the anonymous group processed more directive higher-order feedback (feedback on ideas, organization, argumentation, etc.).

Because it can lead to negative and honest feedback and assessees' deep thinking, anonymity has the potential to boost student learning, which is evidenced by empirical studies. Li (2017) and van den Bos & Tan (2019) found that the anonymous group scored higher on their final products than the group in which identities were known. In addition, anonymous assessors perceived higher learning from PA, as revealed by G.-Y Lin (2018).

In terms of the impacts of anonymity on the perceived fairness of PA and assessment accuracy, research shows mixed results. Güler (2017) found that anonymity did not affect students' perceived fairness of PA. Student

interviews suggested that most of the students who were concerned about the fairness of PA were in the non-anonymous group. However, anonymity resulted in assessors' lower perceptions of fairness of peer comments in G.-Y. Lin (2018). Anonymity may also compromise the accuracy of peer rating. A meta-analysis of empirical studies (H. Li et al., 2016) found that non-anonymous PA led to a higher correlation between peer and teacher ratings than anonymous PA. Anonymous assessors may provide harsher criticism and anonymity may lead to a lack of accountability (H. Li et al., 2016). However, Güler (2017) found a higher correlation between peer and instructor ratings in the anonymous group than in the non-anonymous group.

Another negative impact of anonymity is that it may lead to superficial engagement, as suggested by (Mostert & Snowball, 2013). Being aware that the instructor and assessees do not know who provided the feedback, assessors may not invest effort in providing quality feedback. When PA is anonymous, one strategy to ensure feedback quality is to ask students to evaluate peer feedback, as suggested by (Mostert & Snowball, 2013).

When it is not viable to make PA anonymous, instructors can employ strategies to mitigate the negative impact of non-anonymity on student learning. One strategy is to sufficiently explain why PA activities are used. Li (2017) educated students on the purpose and benefits of PA and informed them of the protocol the study used to address their concerns related to being identifiable. Students who received the training scored higher on their final projects than those who did not.

GUIDELINE 2.3 (PA DESIGN): COMBINE PEER GRADING AND PEER COMMENTS TO MAXIMIZE STUDENT LEARNING, AND ENCOURAGE ASSESSORS TO ADDRESS BOTH STRENGTHS AND WEAKNESSES AND PROVIDE SUFFICIENT EXPLANATIONS.

Requiring students to grade their peers' work and provide comments seems to maximize learning benefits. Hsia et al. (2016) found that the mixed-mode group (the group that graded their peers' work and provided feedback) provided more detailed feedback than the group that only crafted peer feedback. The scores provided by the mixed-mode group were more correlated with those awarded by the instructor than those provided by the peer grading group (the group that only graded their peers 'dance performance without composing peer feedback). Students who received both peer feedback and peer grading achieved the best dance performance, while those who only received peer feedback performed the worst. Similarly, Fang et al. (2021) found that the experimental group in which pre-service teachers collaboratively rated and provided comments on another group's video projects created higher-quality products and showed higher self-efficacy in successfully completing the course and in critical thinking tendencies than the control group who only rated their peers' work.

In terms of the content of peer feedback, comments about both strengths and weaknesses should be provided. Cho & Cho (2011) found that providing weakness comments at the micro level (i.e., the content within one paragraph) and strength comments at the macro level (i.e., the content across several paragraphs) of peers' laboratory reports positively affected the quality of assessors' own revised reports. This is probably because when assessors were reviewing their peers' reports, they developed a better understanding of how readers would interpret their reports and learned from their peers the effective strategies for writing a report. However, the comments on strengths of surface features negatively affected the quality of assessees' final drafts. The authors speculated that the comments on strengths might have led to assessees' over-confidence in their writing quality.

In addition, assessors need to provide sufficient explanations in their feedback. Explanatory feedback can lead to assessees' positive perceptions of the feedback, as shown by Huisman et al. (2018). It can also make it easier for assessees to act upon the feedback (J. Lu & Law, 2012). In addition, the explanations can improve assessors' and assessees' academic performance. In a study by Noroozi et al (2016), feedback quality was assessed in terms of whether feedback on the elements of high-quality argumentative essays and feedback justifications were provided. The study found that students who provided and received more constructive and justified feedback scored higher on their argumentative essays.

GUIDELINE 2.4 (PA DESIGN): USE STRATEGIES TO ACTIVELY ENGAGE ASSESSEES IN PA

In order for PA to be successful, assessees should be actively engaged in PA. The literature discusses several strategies to promote assessees' mindful reception of peer feedback. First, instructors can ask assessees to specify the feedback they need, which can direct assessors to provide feedback that addresses their peers' concerns and thus improve the quality of peer feedback (M. Gielen & De Wever, 2015c). In a study by M. Gielen & De Wever (2015c), a peer feedback request significantly enhanced the quality of peer feedback over time. The second strategy is to ask assessees to explain how they used feedback (Yang, 2011). Third, instructors can ask assessees to evaluate assessors' ratings and peer feedback. In a flipped nursing education class (H.-C. Lin et al., 2021), assessees evaluated whether assessors' ratings were reasonable and responded to peer feedback, the purpose of which was to provide students with an opportunity to make reflections. In a study by Yang (2011), assessees evaluated

assessors' comments on their essays and responded to the comments (e.g., "Thank you for the suggestion. I'll revise it.") (p. 691). In an online class (Filius et al., 2018), in addition to having a dialogue with assessors about the peer grading and feedback, assessees rated the feedback they received. Assessees reported during the interview that having to rate peer feedback forced them to read the feedback in detail and look critically at their own work.

GUIDELINE 2.5 (PA DESIGN): ENCOURAGE INTERACTIONS BETWEEN STUDENTS

Vagueness has been revealed as one of the reasons why assessees do not use peer feedback (Min, 2005). In online classes where students rarely communicate with their peers in person, synchronous or asynchronous discussions can lead to better understanding of feedback and peer ratings and improve students' academic performance. In one study (Zheng et al., 2018), the students in the experimental group had online synchronous discussions after assessing their peers' essays while those in the control group did not. The experimental group outperformed the control group in writing quality, peer feedback quality, metacognitive awareness, and self-efficacy in PA. Similarly, the asynchronous discussions on peer feedback in Kim & Ryu (2013) seemed to contribute to students' confidence and satisfaction and the quality of their instructional design projects.

Research shows that students have a favorable attitude towards discussion. In one study (Yu, 2011), students in a teacher education class conducted PA in one of three modes (one-way, two-way, and multi-way) when they assessed multiple-choice questions that were generated by their peers. The questions pertained to an instructional principle that the students had learned about. Each student generated two questions, and each student assessed four randomly assigned questions. The one-way mode did not allow assessors and assessees to discuss peer ratings and feedback. In the two-way mode, assessors and assessees had conversations about the peer ratings and feedback. In the multi-way mode, online conversations took place between assessors and assessees as well as among multiple assessors. Students preferred the multi-way and two-way modes to the one-way mode because the multi-way and two-way modes yielded a better understanding between and assessors and assessees. These two modes can be particularly useful for online courses.

Research shows that required discussion is more beneficial than optional discussion. In Filius et al.'s (2018) study, assessors and assessees discussed feedback in a discussion forum, but the discussion was optional. Few students participated in the discussion. Student interviews revealed that one possible reason for students' disengagement in the discussion was that it was optional. Another possible reason was that students needed to go to another platform for the discussion.

GUIDELINE 3 (IMPLEMENTATION): PROVIDE STRUCTURE AND USE TECHNOLIGIES TO HELP ENSURE A SMOOTH IMPLEMENTATION OF PA

Providing structure means making expectations clear for students (Connell, 1990) and providing procedures to follow (Reeve et al., 2004), and support, strategies and guidance students can use to complete academic tasks (Connell, 1990; Skinner & Belmont, 1993). Providing structure can enhance students' engagement in academic tasks, intrinsic motivation, and learning outcomes (van Loon et al., 2012). For PA activities, structure can be provided in the form of a script or a template that includes statements or questions to guide PA, criteria that can be used to assess peers' work, elements that high-quality products should include, or information (e.g., definitions and examples of local and global errors) that can help students complete the PA activity. Noroozi et al (2016) used a peer feedback script that included questions to guide the provision of feedback on two peers' argumentative essays and what should be included in high-quality essays. Papadopoulos et al. (2012) provided students with review guidelines that consisted of three questions to direct students' attention to the content, argumentation, and expression of their peers' answers to open-ended scenarios. In M. Gielen & De Wever (2015a), the non-structure group was provided with the evaluation criteria. The basic-structure group received two questions ("What do you like about your peers' work?" and "What would you change in your peers' work?") to guide PA, in addition to the evaluation criteria (p. 318). In another study by M. Gielen & De Wever (2015c), the peer feedback template included four sections: (a) a list of the criteria that could be used to assess their peers' abstracts for scientific papers, (b) a section to provide feedback on how their peers did, (c) a section to make suggestions for improvement, and (d) a section for the writer of the paper to evaluate the quality of the feedback they were given. The PA system Yang (2011) created provided definitions and examples of local and global errors for students who assessed their peers' essays.

How elaborate should the script or template be? Empirical studies show that a basic template that lists the assessment criteria and that reminds students to assess how their peers did and provide suggestions for improvement can lead to effective feedback (M. Gielen & De Wever, 2015a) and improve the quality of students' final products (M. Gielen & De Wever, 2015b). A template that was highly elaborate did not seem to be much more beneficial than a simple one. For example, the highly elaborate template in M. Gielen & De Wever (2015a) and (2015b) asked assessors to formulate feed up (i.e., state the goal), feedback (i.e., assess how peers did), and

feed forward (i.e., offer suggestions for improvement) for each of the ten criteria. M. Gielen & De Wever (2015b) found that the elaborate structure led to feedback of higher quality than no structure did and that the elaborate and basic structure brought about higher product scores than no structure. M. Gielen & De Wever (2015a) found that the basic structure led to more feedback elaborations, but the elaborate structure did not. Findings from the two studies suggest that the elaborate structure was not necessarily more effective than the basic structure.

Technologies, necessary for online PA activities, are of paramount importance for some particular PA activities. For example, without technologies, it is impossible to keep track of who reviewed what when students freely select the work to review, as in Papadopoulos et al. (2012). Although most of the technologies in the literature were created by the research teams (e.g., Author, 2018; Kim & Ryu, 2013; Yang, 2011), there are free technologies that can be used for PA. The students in van Den Bos & Tan's (2019) study used the free online program called Peergrade. Instructors can also use technologies that are not designed for PA but can facilitate PA activities. These technologies include but are not limited to instant messaging and social networking tools. WhatsApp was used for anonymous PA in a study by Güler (2017). The correlation between peer and instructor ratings showed that the PA facilitated by WhatsApp was valid. Blogs were used in Novakovich (2016) and Novakovich & Long (2013) where students provided feedback on their peers' writing. Both studies showed that blog-mediated peer feedback enhanced students' learning outcomes. Additionally, learning management systems can also be used for PA. Mostert & Snowball (2013) used Moodle for anonymous PA in a large-enrollment class.

CONCLUSION

SUMMARY

PA is widely implemented in higher education, and it can play an important role in online learning by connecting students to their peers and enabling feedback from multiple sources. However, peer feedback of high quality is not guaranteed for many reasons, such as students' lack of PA skills, the psychological and social factors that inhibit students' honest feedback, and students' unwillingness to expend effort to provide quality feedback. In addition, students tend not to use peer feedback. In an era in which online learning is ubiquitous, guidelines that can inform instructors on how to prepare for, design, and implement PA are immensely helpful, especially for the instructors who are relatively new to distance education. This paper proposes the above guidelines based on a review of empirical studies that aimed to improve the effectiveness of technology-facilitated PA. These guidelines can help online instructors make PA activities effective.

LIMITATIONS AND SUGGESTIONS FOR FUTURE RESEARCH

One limitation is that almost all the studies reviewed were conducted in face-to-face courses, although the PA interventions were facilitated by technologies. Only one study, Filius et al (2018), was conducted in an online course. Although the technology-facilitated PA studies can provide implications for PA activities for online learning, the interventions in those studies may have different impacts on online students. Future studies are needed to validate the guidelines. Another future research direction is to test and refine the guidelines in a STEM context. Many of the studies reviewed focused on writing and teacher education courses. Students taking STEM courses, such as engineering, physics, and chemistry courses, may have different needs and different attitudes towards PA.

Statements and Declarations

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Improving E-Assessment Based on University Students' Experiences

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ABSTRACT
The application of electronic assessments (e-assessment) has become inevitable with the expansion of distance education, and learners' perceptions should be considered when designers improve the system to meet their needs and facilitate their acceptance of the system. This mixed descriptive study investigated university students' perceptions about e-assessment system. Data were collected from 308 students at King Saud University during the second semester of 2021, by using a questionnaire that consisted of 34 Likert scale items and two open-ended questions on students' opinions. The results showed the suitability of e-assessment to the university courses, and the importance of rendering guidance to students before the e-exam by providing a user manual, mock exam, and furnishing clear instructions; ensuring flexibility of use; supplying quick academic and technical support during the e-test; and providing immediate feedback to increase students' motivation and learning retention. The findings highlighted students' concerns regarding the type of exam questions, cheating, and techniques of monitoring and verifying their identities. These findings expected to guide administrators, decision makers, researchers, and system developers to design or customize some features of assessment systems for the achieving best practice of evaluation and measurement of higher education students.
Keywords: Distance Learning, E-Testing, Online Assessment, Online Feedback, Online Learning

RESEARCH BACKGROUND

The concept of Assessment
There is a growing interest in the field of education systems to identify indicators and information that help teachers in developing curricula and designing activities and tools to improve students' learning. Assessment is an essential component (Crisp et al., 2016) and a core element in educational systems (Alsadoon, 2017) that provides a performance indicator for both students and teachers (Marriott, 2009). The assessment of learning outcomes is a major concern of educational institutions (Soeiro et al., 2015) for various reasons. First, assessments help us to understand the learners' performance as related to stated objectives (Dabbagh et al., 2018), thus students will know when they are approaching their identified learning goals and teachers will know whether their teaching methods and approaches are appropriate for students (Alsadoon, 2017). Assessment data can be used to reflect the quality of the learning materials, especially when the majority of students do not attain the stated objectives (Dabbagh et al., 2018). Indeed, teachers and learning institutions may modify learning materials and methods based on information gained from assessment. Assessment helps institutions to provide evidence that prove students' competencies for educational policy makers, parents, benefactors, and employers who offer jobs to graduates from their institutions (Alsadoon, 2017). In addition, assessments can motivate learners when their teachers encourage them to attain a particular level (Booth, 2019) that is, they know their learning is monitored through assessments. Therefore, it is imperative to conduct studies to determine the reality of using assessments in education and to understand the students' perspective to develop recommendations that contribute to achieving the assessment objectives.
Assessment is defined as "the process of collecting data to determine the extent to which a person's performance or product or program has met its intended objectives" (Dabbagh et al., 2018, p.173). Gaytan and McEwen (2007) confirmed that it is important for educators to predetermine the purpose of assessment, measured criteria, and desired outcomes to achieve meaningful assessment.

E-assessment: Opportunities and Challenges
The use of technology has led to significant changes and improvement in higher education environments (Alruwais et al, 2018; Crisp et al., 2016) and one of the changes influenced by technology in education is assessment (Rostaminezhad, 2019). The increasing number of students aligning with limited seats in higher education, improvement of educational technology, and accreditation of many programs in universities have resulted in widespread online learning. This new trend in electronic learning (e-learning) necessitates the usage of more efficient exam tools, such as electronic assessment (e-assessment) tools instead of traditional paper-based exams (Kuikka et al., 2014). E-assessment can help in creating innovative assessment practices that augment students' learning motivation and engagement (Marriott, 2009; Pham, 2022). According to Soeiro et al. (2015), the learning components are very complex, and they include defining adequate assessment practices that address the expected outcomes from the students. However, using online learning assessment brings an additional level of complexity to the process.

Al-Azawei et al. (2019) argue that e-assessment is much more effective than traditional assessment methods, and this argument is only applied when it is well-designed and well-applied.

Distant online courses use e-assessment to gauge students' skills or knowledge from a distance through computers and this makes the results available electronically quickly, and stored in electronic personal records (Alruwais et al., 2018; James, 2016; Kassem et al., 2015). Alruwais et al. (2018) argue that in most studies e-assessment has been identified as an electronic assessment or computer-based assessment where all its procedures from the beginning to end must be carried out electronically, which implies that the test design, execution, response recording, and delivery of feedback should be completed electronically.

E-assessment has many advantages: flexibility of conducting exams with regard to location and timing, lower cost over traditional paper assessment, and reduced efforts and lesser pressure on instructors as it is easier to review questions and create exams from question bank, and automatically grade students' responses of the objective questions type. The embedded multimedia (e.g., images, voices, animations) in test questions can provide interactive and engaging assessments and it is possible to give immediate feedback (Gaytan and McEwen, 2007; Gogno, 2014; James, 2016). In addition, Kassem et al. (2015) found that providing formative online assessment is an efficient means that improves students' self-learning skills, learning outcomes, and information retention. Furthermore, e-assessment can be used as a substitute in emergency situations that prevent physical presence, such as the COVID-19 pandemic. Gogno (2014) argues that online tests are more accessible and convenient for students with disabilities as they can use computers with assistive technologies. While it is difficult to prevent cheating in e-exams, teachers may use randomize questions settings, impose time limits to take exams, and restrict attempts (Gogno,2014) that are executable in all e-assessment systems.

James (2016) reported that there are a wide range of e-assessment-related activities in education including the submission of online essays to the fully automated online self-assessment with instant feedback. Jordan (2013, p. 100) confirmed that "we should use computers to do what they do best, relieving human markers of some of the drudgery of marking and freeing up time for them to assess what they and only they can assess with authenticity." Gaytan and McEwen (2007) reported that faculty and students found the use of projects/portfolios, self-assessment, threaded discussions, and the use of rubrics in online courses to be very effective.

Although using e-assessment is considered to be crucial in distance learning, there are some challenges in its design and implementation. Tarricone and Newhouse (2016) argue that the teachers' expertise in the design and application of the instrument and their judgment and evidence of students' performance are considered to be the main factors that influence assessment reliability. In addition, Crisp et al. (2016) found that there is significant interest in authentic assessment tasks and such new approaches of e-assessment are necessary to assess higher-level cognitive skills that cannot be assessed using selected-response formats. This means that some skills need to be assessed using constructed-response, where the students write their answers (e.g., essays) and teachers read the answers before scoring them. Jordan (2013, p. 100) clarifies that "there are some assessed tasks (e.g., experimental reports, essays, proofs) that present considerable challenges for machine marking." Hillier (2014) confirmed this and reported that students are cautiously optimistic about being able to type their answers in e-exams.

Dabbagh et al. (2018, p. 176) argue that complex learning outcomes (e.g., assessing projects that require data collection, followed by conducting experiments, and then creating reports about the work) are more difficult to assess than simples ones (e.g., recall and recognition tasks). In general, complex learning outcomes need to be assessed by multiple tools of assessment such as tests and quiz tools, digital portfolio systems, student response systems (e.g., clickers), or immersive technologies (p. 177). A study conducted at the Centre for Schooling and Learning Technologies (CSaLT), Edith Cowan University, Perth, Western Australia found that technologies were insufficiently used for high-stakes assessment in tertiary entrance, although it is available in educational institutions (Tarricone and Newhouse, 2016).

Rostaminezhad (2019) raises some questions that need to be investigated through research: when is instant feedback in e-assessment good for students and when does it have negative effects, such as increased exam anxiety? Furthermore, proctoring students during the test and ensuring their identities are important issues that influence teachers' and institutions' perceptions about e-assessment systems. Adebayo and Abdulhamid (2014) found that cheating can happen in e-exams and there is a possibility for technical problems owing to network failure or computer malfunctions.

E-assessment plays a significant role in higher education. It has been widely used at King Saud University (KSU) in recent years, especially with the launch of distance learning courses in 2018/2019 at the College of Education, Arts, Sports, Business Administration, Tourism, and Archaeology, Medicine, and Nursing. During the COVID-19 pandemic, the number of final electronic exams conducted remotely in the second semester (April/May) of 2021 using only the Blackboard learning management system was 5559, and the number of students who submitted the e-test at that time was 113,475 (Deanship of e-Transaction and Communication, 2021).

E-assessment in King Saud University

Professors at KSU may use different e-assessment systems, not only LMS tools, including free and commercial systems. Nearly all of these e-test systems have a common set of features that include true/false questions, multiple choice questions, essay questions that need key words to match the students' answers, options to attach answer files, and others. In addition, most systems allow professors to create a question bank according to the difficulty of each question, having the option to reorder the questions for each student randomly, and/or randomly assigning multiple-choice questions for each student. Al-Smadi et al. (2009) argue that when defining the services of the electronic system, it is important to know that there is no "best practice" for performing it; instead, one should be concerned about how to implement the services, focusing more on the functionality of the service and how it functions in conjunction with other services.

This implies that when using an external e-assessment system, it is important to consider how to integrate the e-assessment system with other university systems, especially the academic system that saves students' records and their grades as well as the LMS. Some colleges under KSU prefer to integrate commercial features into the Blackboard LMS, in order to proctor students. However, proctoring students seems to be challenging as many students are confused about opening the camera during the exam and about using artificial intelligence technology as an alternative to human monitoring. Adegbija (2012) recommended the importance of training students and faculties to achieve the best results. Alasfor (2021) concluded that researchers and practitioners need to pay attention to conservative cultures when they employ distance education in segregated campuses (such as in Saudi Arabia). Some female students may be dissatisfied and not agree to showing their faces during the exam, especially when an instructor of a different gender may need to check their identity or return to the recording video to ensure that there has been no cheating.

Despite the keenness of KSU to provide support and assistance through the Deanship of e-Transaction and Communication, which continues to publish guidance and advice to ensure the smooth running of e-exams, the dean received many complaints regarding technical problems. For example, the number of requests that the Deanship received during the final electronic exams of the second semester of 2021 (April/May) included 237 calls regarding LMS technical problems and 207 chats from 45 teachers and 41 students (Deanship of e-Transaction and Communication).

In this regard, the current study aimed to investigate students' perceptions about the effectiveness of providing different forms of guidance before the e-exam, their opinions regarding the features of e-assessment system, their attitudes of e-assessment in comparison with the traditional ones, and their attitudes toward verifying the students' identity and monitoring them during the e-assessment. Based on the technology acceptance model, students' attitudes and their confidence have a significant impact on their acceptance of each technology (Rostaminezhad, 2019), and this could also affect their performance. Moreover, many previous studies (Gaytan and McEwen, 2007; Kuikka et al, 2014; Alkharusi, and Alwahaibi, 2021) recommended the importance of using e-assessment in educational institutions, the need for further research to explore their efficiency, and the best techniques for assessment in an online environment by examining students' attitudes. This is an important issue considering the expansion of distance learning courses, whether for graduate studies or diplomas at KSU. Khare and Lam (2008 cited in James, 2016) noted that the academic literature in e-learning gives more focus to teaching pedagogies while there is little attention on e-assessment. To the best of my knowledge, this is the first study investigating students' perceptions on e-assessment conducted on a sample from a whole university using both quantitative and qualitative methods, that help in improving the e-assessment systems and customizing services to satisfy students' needs. Indeed, the results of this study can guide administrators, decision makers, researchers, and system developers to design or customize some features of assessment systems for the achieving best practice of evaluation and measurement of higher education students.

METHODOLOGY

This study aimed to understand the students' perceptions about the e-assessment, make recommendations that could improve it, and maximize its efficiency among students in the university. It is important to study students' perceptions to determine the services that suit learners and generally higher education students, as one of the advantages of e-assessment systems is customizing services based on beneficiary needs. Therefore, this research sought to answer the following questions:

1. What are the students' perceptions regarding the importance of providing different forms of guidance before the e-exam?
2. What are the students' opinions regarding the features that they need in the e-assessment system?
3. What are the students' attitudes toward the feedback of the e-test?
4. What are the students' attitudes toward their experience of e-assessment in comparison with traditional ones?

5. What are the students' attitudes toward the techniques that can be used for verifying their identity and monitoring them during the e-assessment?

To answer the research questions, a mixed descriptive research method was used. According to Lodico et al. (2010) descriptive research studies participants' perceptions, attitudes, behaviors, and beliefs regarding particular issues or trends. Data were collected from students by using an online questionnaire, and according to Wellington (2015), the questionnaire is the most commonly used format for giving an overview or a "wide picture."

The study was conducted during the final exam of the second semester (April/May) of 2021 among undergraduate and postgraduate students at KSU in Saudi Arabia. All students were subjected to e-assessment owing to the COVID-19 lockdown. The sample included female and male students in KSU, and their ages were eighteen and above. The population of the study included 63,891 students (SPA, 2021); and 308 responses have received. The online questionnaire was constructed based on existing literature; it consisted of 34 closed-ended questions related to students' perceptions about their experience of e-assessment and two open-ended questions. The first 34 closed-ended questionnaire items were based on a 5-point Likert scale ranging from totally disagree (1) to totally agree (5). These items were related to students' perceptions regarding the importance of providing different forms of guidance, features that they need in e-assessment system, feedback, techniques of monitoring and verifying their identity, and their experience of e-assessment in comparison with the traditional ones. The participating students were supposed to tick the level they believe was appropriate (see appendix A).

To measure the reliability and validity of the questionnaire, a pilot test was conducted with 73 undergraduate students in KSU after their e-exam, prior to the full distribution of the survey to all students. The results revealed that the alpha coefficient values for all parts of the questionnaire parts were between (0.882) to (0.966), and it was (0.977) for the overall questionnaire, which is considered to be very high. The internal consistency of the questionnaire was calculated by using the Pearson correlation, and the results revealed that all items in the questionnaire were statistically significant and valid to be used for this study. In addition, this study provides sufficient information about the e-assessment in KSU, research design, data findings, and analysis to enable any individual to decide the possibility of transferring the findings and conclusion to other settings or contexts, or even transfer them to the same context at any other time (Korstjens and Moser, 2018; Lincoln and Guba, 1985)

The data were collected through the distribution of the online questionnaire link to the university email addresses of students once my research was approved by the Standing Committee for Scientific Research Ethics at KSU (Ref No: KSU-HE-21-346). Descriptive statistics, including percentages, and means, were used to present the numerical data of each item (see appendix A) in conjunction with the application of statistical techniques as a "sense making" to the non-compulsory open-ended questions, to measure the students' perceptions and gain insight into the effectiveness of e-assessment and provide recommendations that could improve the e- assessment systems.

RESULTS

The average percentages of each question areas, and means are presented in the table below.

Table 1: Students' Perceptions of E-assessment

Areas	Strongly agree (%)	Agree (%)	Neutral (%)	Disagree (%)	Strongly disagree (%)	Mean
The Importance of Providing Different Forms of Guidance before the E-exam	46	25	12	10	7	4.02
The Needed Features in E-assessment System	64	21	8	4	3	4.36
The Feedback of the E-test	64	19	11	4	2	4.42
E-assessment in Comparison with the Traditional Tests	40	24	14	11	11	3.95
Monitoring and Verifying Identity Techniques	28	18	15	15	24	3.66

The majority of students admitted that providing different forms of guidance before the e-exam is important. 46% of responses strongly agreed, and 25% agreed (Figure 1). The highest important guidance that respondents "strongly agree" on was providing a user manual showing how to solve the test questions.

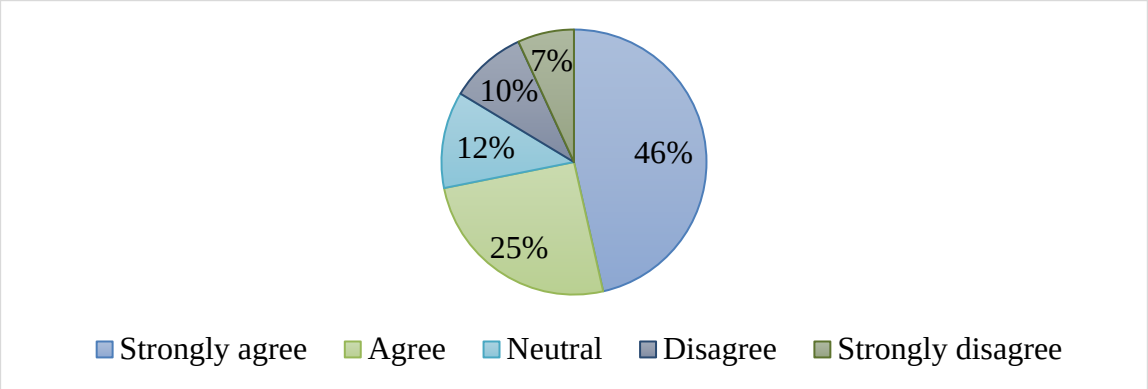

Figure 1: The percentage level of agreement with the importance of providing different forms of guidance

It seems that students prefer to receive instructions through infographics; the open comments from students confirm their need for a user manual describing the test format and how to move onto the next question. One of students commented, "I was afraid when I press the Enter button to move to the next row, that my exam is submitted!". Other students believe that mock exams are highly important as it makes them familiar with e-exam and reduce stress. Interestingly, some students commented in the open questions that the professors need to take training sessions to efficiently use the exam built-in tool in the Blackboard.

Regarding the needed features in e-assessment system, respondents' answers were generally "strongly agree" with general mean 4.36 to the survey items. About 85% strongly agreed or agreed (Figure 2).

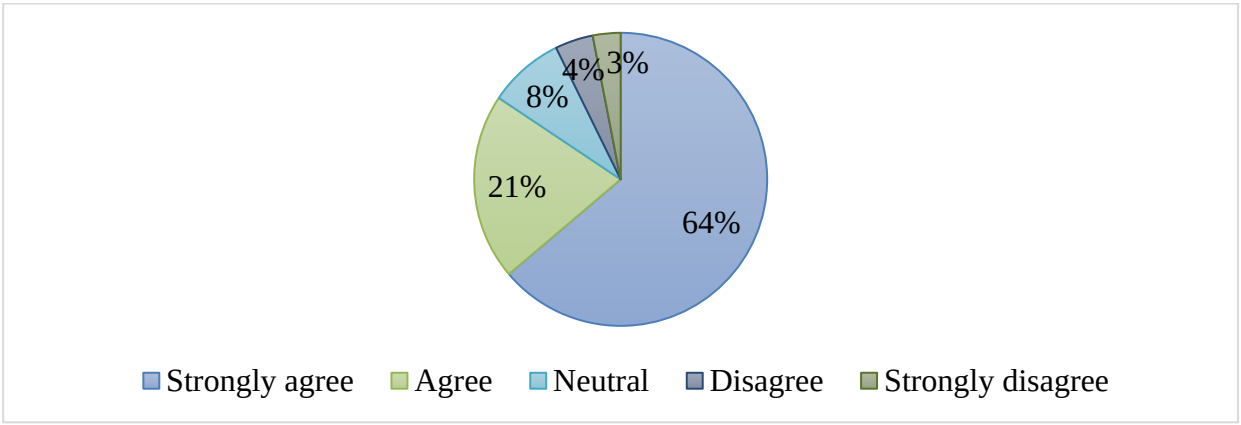

Figure 2: The percentage level of agreement with the needed features in e-assessment system

The most important three features that the e-assessment system should include based on students' perceptions were: providing clear instructions including: the number of questions, how to answer them, and the test duration; the system saves the answers automatically, in the event of an Internet failure; the high flexibility and ease of use. Some students explained the flexibility they need, that is, to attend the exam at their time of preference during the day and in the event of a technical glitch, to complete the exam in the same duration after the problem is fixed, to use the system in any electronic device (mobile phones, laptops, iPad, etc.), to move between questions, and having the option to write comments. They suggested that the system shows the professors the reason for students' disconnection (disconnected by the user or by the system), and this would increase the fairness of the system. Some students found difficulties with regard to the Arabic language in the e-assessment system—when the professors wrote questions that combined both Arabic and English texts, the words of the sentence appeared in incorrect order.

Other suggestions from students included the following: option to mark the questions that students need to return to; give alarms when the students pass half the exam duration; provide calculator and other supplementary tools; ease of communicating with teachers during the exam and having a voice chat with them to clarify some questions when needed; and the option to write notes deliver them to teachers.

Regarding the feedback of E-test, students' responses were generally "strongly agree" (with general mean 4.42), and the majority confirmed that that getting immediate feedback helps them to retain the information and motivates them. Only about 4% disagreed and 2% strongly disagreed (**Figure 3)**. The top two feedback styles they preferred

were: the appearance of the total score immediately after completing the test; and providing detailed explanation about the wrong answers. Students commented that the essay questions are corrected by professors in most situations, and this is an area that needs improvement because automatic corrections do not provide detailed explanations regarding the students' mistake.

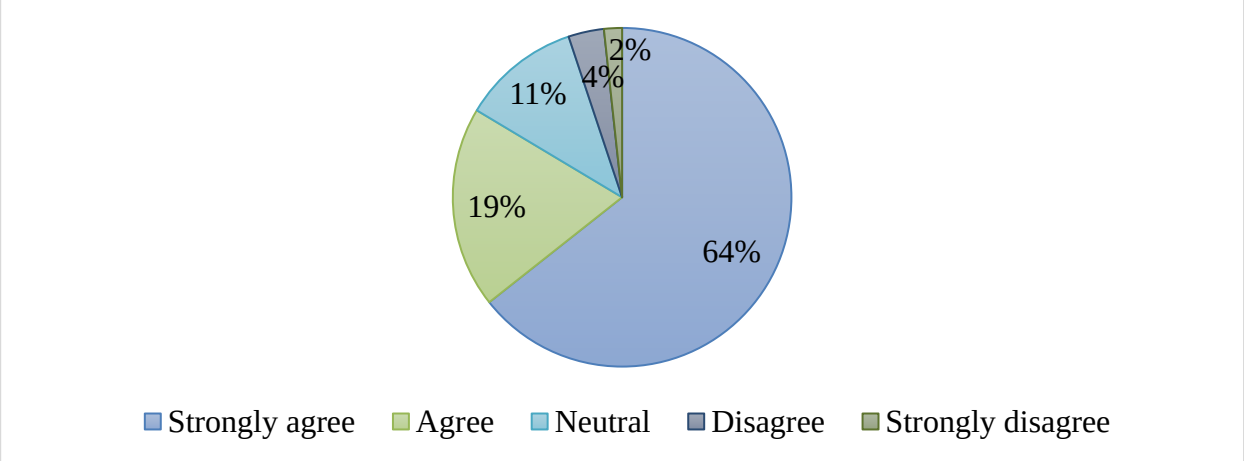

Figure 3: The percentage level of agreement with the feedback of the E-test

More than half (64%) of the students admitted that they were more comfortable using e-tests than traditional ones (**Figure 4)**, and some of them commented that taking an exam from home is more psychologically comfortable.

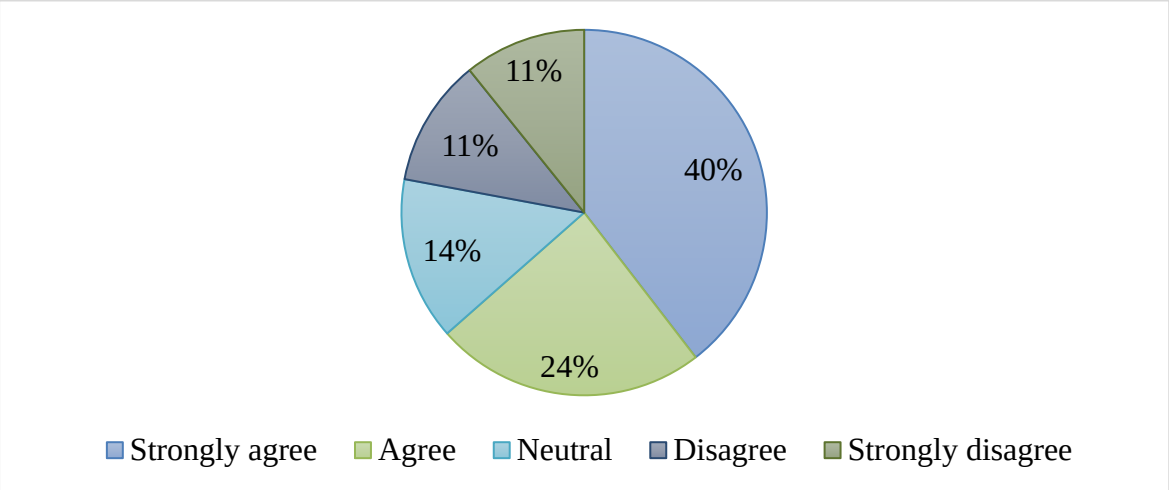

Figure 4: The percentage level of agreement with E-assessment in comparison with the traditional tests

Interestingly, the majority of students (over 79%) found that the types of questions in e-exam were in line with the learning objectives of the course, and over 56% believed that their achievement level in the e-test is not different from that in the traditional test. However, further examination of students' comments revealed complaints regarding the inappropriate nature of questions with respect to subjects. They commented that some professors used only multiple-choice questions while their subjects necessitate including questions regarding their perceptions and writing explanations; professors also decreased the exam duration to prevent cheating. Others commented that some professors reduce the duration, not allowing students to return to the previous questions to prevent cheating, and this negatively affects the "fairness" concept of e-tests.

Furthermore, the results of monitoring and verifying identity techniques showed a 46% total percentage of agreement among students with the survey statements of this area, and 15% of students did not either disagree or agree, while 39% disagreed (Figure 5). Students' responses revealed that they strongly agreed to verifying their identity by logging into the system using their university email address and password, and they also agreed to taking the audio attendance by using a microphone or by being present in a simultaneous session with the course professor during the exam, with the possibility of calling them by their names.

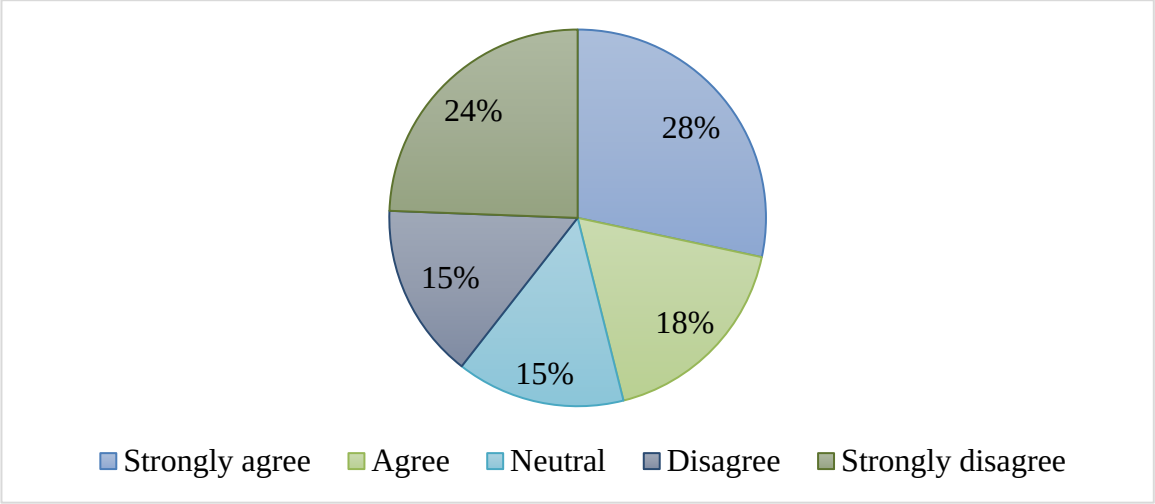

Figure 5: The percentage level of agreement with monitoring and verifying identity techniques

On the contrary, students' responses uncovered their disagreement regarding three techniques of verifying their identity as follows: opening the camera and placing their university card in front of it at the beginning of the test; opening the camera at the beginning of the test and matching their current photo with their photo in the academic system; and opening their camera during the entire test period.

Some students in the current study confessed that the test timing of one of their tests coincided with the time of call for prayer (Athan) and the proctoring program showed an indication of the possibility of cheating owing to the sound of Athan.

DISCUSSION

The findings of this study revealed that students appreciate providing guidance and conducting a mock exam before the e-exam, which support James (2016) study where students found providing guidance prior to the exam was comfortable and caused less anxiety. The high preference for a clear user manual by the participants in this study is evidence that visualization of data (infographics) can convey complex information that people can quickly and easily understand (Smiciklas, 2019).

Participants in the current study confirmed the importance of having an e-assessment that provides clear instructions, automatically saves their answers, is flexible and easy to use, and enables teachers to see and know technical problems faced by the students or inquiries while they are taking their exam and provide support simultaneously. These are important features that should include when using e-assessment as in previous studies (e.g. Alruwais et al., 2018; Faniran and Ajayi, 2018; James, 2016; Rostaminezhad, 2019) reported that poor technical infrastructure in some countries or institutions, high stress owing to unfamiliarity with technology and test conditions, and lack of direct contact to get clarification during the exam are the challenges of using e-assessments.

In addition, the comparison results of e-assessment with traditional tests in this study are consistent with the findings of previous studies (Alruwais et al., 2018; Alsadoon, 2017; Bandele et al., 2015; James, 2016; Rudland, et al., 2011; and Faniran and Ajayi, 2018). E-tests were also preferable owing to the ease of reading questions from a screen, no requirement for advanced technical skills from students, lower anxiety level, unbiased grading, and immediate feedback, and it helped faculty to improve learning and the quality of assessment in higher education. About 40% of students in James's (2016) study expected to have better performance owing to being in a comfortable place with fewer distractions, such as poor lighting or the temperature of the room.

In the study of Flowers et al. (2011) staff and both ordinary students and students with disabilities preferred e-tests to the paper-based exams, and students believed their performance was better when using a computer. However, some studies revealed neutral attitudes regarding e-tests, such as Dembitzer et al. (2017) and Kim (2015) who classified students into four types regarding their attitudes toward e-tests: (I) dissatisfaction type, (II) friendly type, (III) adjustment seeker type, and (IV) apprehensive type. Flowers et al. (2011) recommend additional research to better evaluate the relationship between testing modes and students' performance, where the extraneous factors are controlled, such as teaching time and familiarity with testing environment.

Regarding e-test feedback that participants prefer, the findings in this study are consistent with the results of Alruwais et al. (2018), Alsadoon (2017) and Rudland, et al. (2011) where the students preferred receiving immediate

feedback in e-assessment on their performance. Alruwais et al.(2018) confirmed that using an online assessment gave the students the opportunity to know their level of understanding and make improvements based on their progress and correct their misconceptions on learning; this further encouraged deep learning among the students that improved their performance.

The findings also support those of Rostaminezhad (2019) who investigated students' attitudes toward e-testing and instant feedback, and he found that getting instant feedback reduced students' stress of waiting for paper-based exam results; students believed that seeing the results right after the exam is very productive. However, students in his study also faced challenges that need consideration. One of the challenges is that students are demotivated to take other tests when they receive immediate feedback about their failure in exams. Based on his research findings, he recommends examining quantitative and qualitative variables when studying learners' attitudes toward feedback such as exam anxiety and personality type (Rostaminezhad, 2019).

Although the quantitative data in the current study revealed that students found the type of questions in online exams to be appropriate, the qualitative data showed that some professors were restricting the questions to only the multiple-choice type and that were not agreeable, especially when students expected essay questions to display their understanding of a particular topic or when testing their practical skills. Topuz et al. (2022) found the most commonly used five question types in many educational institutions during the Emergency Remote Teaching period are multiple choice, essay, true/false, short-answer, and option matching.

Wang (2010) argues that professors can take advantage of students' positive attitude toward multiple-choice questions to employ this type of questioning to reflect students' learning of facts in the courses. Hillier (2014) confirmed that students preferred e-exams in the disciplines that utilized computers as a basic in their learning and assignments, concluding that students complained about having to complete a paper exam on software coding. In contrast, he also found that students in business and social sciences disciplines were somewhat enthusiastic about e-exams. However, Babo et al. (2020) reported that although online tests included theoretical topics, practical topics need to be complemented with other methods to achieve practical learning outcomes. Thus, Hillier (2014) highlights the significance of considering the suitability of the exam nature in various discipline areas. This implies that it is necessary to ensure that e-tests are suitable to the nature of subject in each discipline and measure the educational aims to increase the "fairness" concept of e-tests by students. Alsadoon (2017) stressed the importance of designing assessments that reflect the nature of learning where the students become more responsible for their learning. Thus, questions should not only measure their knowledge, but they should also allow students to demonstrate their capability in solving problems, which reflect the constructivism approach of measuring students' ability in critical thinking and problem solving. Topuz et al. (2022) recommended investigation future research that determine to what extent the development of problem-solving questions that use of graphics and animations in e-assessment meet our need.

However, it is important to remember the learning process cycle (Figure 6) while designing online learning. Learning objectives and goals should be identified clearly at the beginning, based on learning content and the assessment activities that are designed, then they need to be evaluated to ensure that they are compatible with the learning objectives and goals. If not, the learning content or the assessment activities should be redesigned or adapted to support and enhance the learning objectives and goals (Al-Smadi et al., 2009). Thus, e-assessments should be designed to measure the learning goals and display students' competencies and performance related to the identified learning objectives and goals.

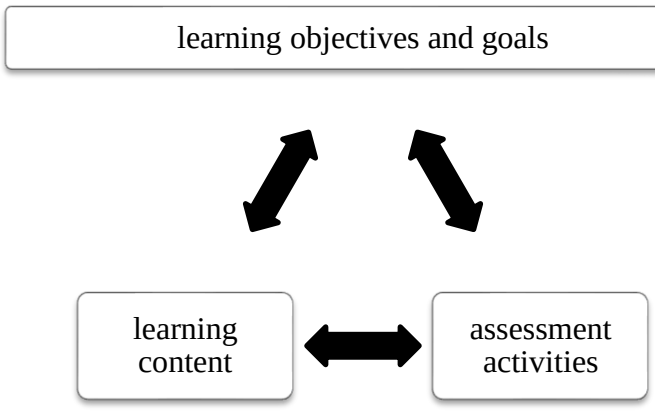

Figure 6: Learning Process Cycle

Soeiro et al. (2015) developed an interactive web-based platform that integrated with another tool to ensure the validity of e-assessment. In this project, the teachers had to describe the learning outcomes for the platform that would analyze them and provide the most consistent e-assessment strategy that aligned with learning outcomes. This process happened based on the link between the learning outcomes with verbs, which were revised based on Bloom's taxonomy and the six general assessment methods (multiple choice questions; essays; problem solving; practical work; short answer questions; and reflective practice assignments). Soeiro et al. (2015) found that this platform not only helped teachers to plan the best e-assessment strategy, but also it supported and guided teachers to formulate the learning outcomes in accordance with Bloom's taxonomy, which increased the accuracy of the learning outcome.

The students in the current study did not worry about cheating in e-tests, as a majority were neutral about this point, which is consistent with Alsadoon's (2017) study where students were positive about the fact that online assessments do not facilitate cheating. Contrarily, Rudland et al. (2011) and Kocdar et al. (2018) found that students considered the possibility of cheating and plagiarism as the main problem in e-assessment. Topuz et al. (2022) found the most commonly used restriction methods in e-assessment for prevent cheating in many educational institutions during the emergency remote teaching period in 2020 are disabling copy/paste, blocking exit from full-screen, turning off print-screen function, deactivating right click, preventing additional software from being run, and enabling unprinting. Kocdar et al. (2018) suggested some dynamics that reduce cheating and plagiarism when using e-assessment including: a) students' and teachers' trust on advanced software that detect cheating and plagiarism; b) students' awareness about the functions of this software and not discrediting themselves or their studies; and c) using both forms of assessment: online and face-to-face. When these dynamics are followed, students would be careful about putting themselves at risk through illegal behaviors in online assessment. More studies are needed to determine the possible strategies that students may use for cheating and how to limit them.

Regarding the techniques for monitoring and verifying identity, the majority of students in the current study "disagree" to using camera during the test. Similarly, James (2016) found that most students did not like being observed by a webcam and they faced inadequate technical support from the proctoring company, especially with regard to the facial recognition software, giving conflicting information when the lecturer allowed students to use some materials while the proctoring system pointed them out as an illegal exam aid. Other concerns of students in James's study were the disruptions from people or distractions from their surroundings, and privacy concerns. Indeed, the study of Castelli and Sarvary (2021) concluded that cameras should be avoided with distance learners due to learners' discomfort, as well as social norms (e.g. intrusion into learners' homes). Topuz et al. (2022) confirm that collecting and analyzing students' biometric data during e-assessment (such as screen record, and images) is considered to be sensitive subject in some countries that requires high attention by law. These findings can guide system developers, researchers and decision-makers to improve the monitoring methods and security to satisfy users' country law.

Topuz et al. (2022) found that students preferred semi-automatic monitoring (machine and human proctoring) over full-automatic monitoring (machine proctoring) because they claimed that artificial intelligence technologies are still insufficient for fraud detection, thus human proctor lead to verification through two steps.

It is necessary to ensure and study the importance of proctoring students during the online assessment, especially when the questions measure their creativity, comprehensive skills, and their critical thinking. Looking at the students' responses in the current study, more than 47% found that cheating in electronic exams is difficult and a majority of students (over 56%) reported that their achievement level in the e-test was not different from that in the traditional test. Thus, it is important to study the need for using cameras during online tests for university students.

CONCLUSION AND IMPLICATIONS

This study has significant findings for higher education institutions, especially with widespread distance learning that necessitates the use of e-assessment. Overall, the findings of this study showed the importance of providing guidance to students before e-assessment, providing instructions during the exam especially the testing duration, not preventing the students from reviewing their previous answers, and having the option to write comments. Our findings suggested that the system should report details in case of disconnection or any technical problems so that students would feel confident.

Finding showed that the majority of students preferred using e-tests over traditional tests and opined that their achievements were not affected when they used e-tests during distance learning. However, teachers need to pay more attention to using suitable questions that match their courses' learning objectives, as well as exam duration, comparing its nature to traditional exams.

The findings strengthen arguments that confirmed the importance of providing immediate effective feedback after the e-assessment. However, findings suggested that essay questions represented challenges with respect to feedback as automated corrections did not provide detailed explanations.

E-assessment systems should customize some features based on the user's needs, especially their language and the procedures of verifying and monitoring students, to increase their comfort and acceptance of the system. The techniques students found appropriate for verifying their identity were logging into the exam system using their university email and password, and taking audio attendance through a microphone or calling students' names by a professor in a simultaneous session. However, the study finding showed that respondents were very conservative to monitoring with the use of a camera, even when privacy was ensured.

Research attention should be given to understanding when the students need proctoring in e-assessment and developing innovative technology to detect cheating and verify students' identities considering their preference and culture.

Findings of this research expected to help decision makers, researchers, and system designers and developers in improving e-assessment systems. Recommendations include conducting future studies that address the effects of different kind of e-assessment systems on students' satisfactions, motivations, and on their academic performance. This study has two limitations: first, the population in this study included only students from KSU in Saudi Arabia during the distance learning period in the COVID-19 pandemic. Second, the sample size is small considering the population, as the number of students in KSU in the latest published statistics was 63,891 students (SPA, 2021).

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Appendix A. Survey of Students' Perceptions of E-assessment

No	Items	Strongly agree (%)	Agree (%)	Neutral (%)	Disagree (%)	Strongly disagree (%)	Mean	Std. Deviation
The Importance of Providing Different Forms of Guidance before the E-exam								
1	Provide a user manual showing how to solve the test questions.	56.5	26.6	7.8	4.5	4.5	4.26	1.081
2	Provide a video explaining how to solve the test questions.	34.4	25.6	17.2	14.3	8.4	3.63	1.310
3	Provide training on how to solve test questions and deal with the system.	41.2	28.2	14.3	9.7	6.5	3.88	1.232
4	Conducting a mock exam where the marks do not count, before the actual exam.	53.6	21.1	7.8	9.4	8.1	4.02	1.313
The Needed Features in E-assessment System								
1	Ease of providing the physical requirements of the system (hardware, Internet speed, etc.).	52.3	30.2	10.1	5.5	1.9	4.25	0.979
2	The ability to deal with the system easily using a mobile phone or laptop.	61.7	25.0	7.5	3.2	2.6	4.39	0.948
3	Providing clear instructions including: the number of questions, how to answer them, and the test duration.	73.1	21.4	2.9	1.9	73.1	4.64	0.696
4	High flexibility and ease of use.	70.5	19.8	5.5	2.6	1.6	4.55	0.843
5	The system saves the answers automatically, in the event of an Internet failure.	73.7	14.6	6.8	3.6	1.3	4.56	0.869
6	The system allows the student to skip some questions and return to them again to answer.	73.4	10.1	4.2	4.5	7.8	4.37	1.236
7	Easy communication with the technical team when there are technical problems.	62.3	17.5	14.6	2.9	2.6	4.34	1.003
8	The ability of answering students' inquiries during the test through the voice chat.	53.6	21.8	14.0	6.8	3.9	4.14	1.003
9	The ability of answering students' inquiries during the test through the written chat.	53.6	24.7	9.7	6.8	5.2	4.15	1.132
The Feedback of the E-test								
1	I prefer the appearance of the total score immediately after completing the test.	77.6	14.3	4.2	1.9	1.9	4.64	0.817

2	I prefer the detailed explanation about the wrong answers.	74.0	18.5	4.5	2.3	0.6	4.63	0.734
3	It is necessary to obtain electronic feedback for each question.	58.4	22.4	14.6	2.9	1.6	4.33	0.941
4	I feel motivated when I get instant feedback after the test.	58.8	25.0	11.0	4.2	1.0	4.36	0.908
5	Getting immediate feedback helps me to retain the information.	69.8	18.5	9.1	1.6	1.0	4.54	0.803
6	The automatic correction makes me feel comfortable, especially since it does not require the intervention of the course professor.	47.4	16.6	24.4	7.5	4.2	3.95	1.182
E-assessment in Comparison with the Traditional Tests								
1	I feel more comfortable using electronic tests than traditional ones.	48.7	19.8	14.0	8.8	8.8	3.91	1.328
2	The use of electronic tests commensurate with the nature of our generation which is passionate about technology.	53.2	20.1	14.0	7.5	5.2	4.09	1.198
3	It is difficult to cheat in electronic exams.	28.9	18.8	19.2	13.3	19.8	3.24	1.490
4	The achievement level in the electronic test is not different from that in the traditional test.	30.2	26.0	17.9	14.9	11.0	3.49	1.349
5	The text formats are suitable for reading from the screen.	54.2	28.6	10.4	4.9	1.9	4.28	0.969
6	The types of questions are appropriate to the learning objectives of the course.	47.1	32.5	12.7	3.9	3.9	4.15	1.041
7	The duration of the electronic test is the same as the traditional test.	26.3	19.5	12.0	20.8	21.4	3.08	1.520
8	The duration of the electronic test is sufficient in relation to the number and nature of questions.	27.9	26.3	15.3	16.2	14.3	3.37	1.407
Monitoring and Verifying Identity Techniques								
1	Verify the identity by requiring you to log into the system using the university email and password.	69.5	23.4	3.6	2.3	1.3	4.57	0.781
2	Verify the identity by opening the camera and placing the university card in front of it at the	14.0	12.3	17.5	22.1	34.1	2.50	1.433

	beginning of the test, while preserving the privacy of the photos.							
3	Verify the identity by opening the camera for the student at the beginning of the test and matching the current photo with his photo in the academic system, while maintaining the privacy of the photos.	14.0	12.3	17.5	22.1	34.1	2.47	1.250
4	Verify the identity through taking the audio attendance by using microphone.	14.9	9.7	18.2	21.8	35.4	3.87	1.319
5	It is preferable that the students be present in a simultaneous session with the course professor during the exam, with the possibility of calling the students by their names.	39.9	31.2	14.0	6.2	8.8	3.79	1.414
6	It is preferable that students be monitored by opening their camera during the entire test period, while maintaining the privacy of the videos.	12.0	9.7	13.3	20.1	44.8	2.24	1.240
7	It is enough to check by IP address to make sure that no students are in the same place.	34.1	25.6	17.2	10.7	12.3	3.58	1.373

Investigation of Secondary School Students' Opinions on Mathematics Lesson with Distance Education

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Abstract
The aim of this study is to examine the opinions of secondary school students about mathematics lessons taught with distance education. The research was carried out by taking the opinions of 286 secondary school students from one state school selected from each of the provinces (Manisa, İzmir, Muğla, Antalya, Şırnak, Bitlis). Quantitative and descriptive survey method was used in the study.

According to the findings, it was seen that the opinions of female and male students were very close to each other, there was no significant difference according to the variables of the number of siblings and whether they had their own study room, and there was a significant difference between 5th grade students and 8th grade students. Students; It was seen that there was no difference in their views on understanding the lesson better and increasing their success, they did not have any problems in accessing the Mathematics lesson, but they had problems due to internet interruptions during the lesson, they did not have any problems in communicating with their teachers and delivering homework during the lesson, but they still preferred face-to-face education at a high rate.

It was observed that the motivation of the 5th grade students during the lesson and their better understanding of the lesson were higher than the 8th grade students.
Keywords: Distance Education, Mathematics, Internet, Success

INTRODUCTION

Since November-December 2019, the Covid-19 epidemic has always taken the first place on the agenda of all countries. In Turkey, the epidemic and its consequences have been discussed every day since March 11, 2020, the first date of the case. Countries have emphasized that the definitive solution for the epidemic is vaccination, and it has been expressed by the World Health Organization (WHO) that every country must take precautions until a vaccine is found. Among the measures taken, they are the measures that will reduce the activities of people outside their homes, which are considered to be the most important measure by countries. The strictest of these is the curfews implemented under the name of "staying at home".

In all countries; The biggest part of out-of-home activity and street activity is the child and youth group. The mobility of students who have to go to school for five days in some countries and six days in some countries has created a concern that the virus will spread much faster. One of the first decisions taken by countries in the fight against covid-19 is the closure of schools to prevent this great activity. The difficulty of the mathematics course in the face-to-face education process is known by everyone. The number of materials and studies applied for mathematics education in face-to-face education is quite high. The mathematics course, which is difficult to understand even with face-to-face education, has become compulsory in today's epidemic conditions. In the distance education, which has been applied both on EBA TV and over internet providers, which continues until today, mathematics course education is tried to be continued along with other courses. For this reason, it is necessary to examine the views of students for the mathematics course taught with distance education. From this point of view, the general purpose and sub-objectives of the research were established. As of March 2020, until the end of the semester, mathematics education broadcasts were made on EBA TV channels. As of August 31, 2020, education has been tried to be implemented in such a way that education at school on certain days, called

"hybrid education model", will be distance education on certain days. However, due to the increasing number of cases as of September, as of November 16, 2020, the country has completely switched to distance education again. Although different methods have been tried at different times, since March 2020, distance education has been continued over the internet and TV broadcasts in order to continue the education. In the epidemic period, when the whole world switched from pre-school education to university education, research on mathematics education was shaped in line with the new education programs and methods applied. In this study on secondary school students, it is thought that it will contribute to the studies on the evaluation and development of distance education, where sufficient scientific studies have not been done yet, thanks to the examination and evaluation of students' views on distance education and mathematics education.

Teaching Mathematics

Mathematics teaching aims to provide the person with the mathematical knowledge and skills he needs in his life, to develop problem-solving skills and to establish such a way of thinking (Altun, 2018).

The effectiveness of a teaching activity that proceeds in the form of transferring mathematical concepts and systematic information as a whole and then solving exercises is discussed. It is thought that the knowledge that is not assimilated, not confronted with life, and put into practice will not be permanent, so it will not create an enjoyable situation for the learner. For this reason, an approach that aims to blend and present the mathematical concepts and thinking skills that the learners will need throughout their lives, with an understanding far from memorization, in accordance with the nature and philosophy of mathematics should be preferred (Işık, Çiltaş, & Bekdemir, 2008).

Covid-19 Outbreak

The disease, which first appeared in Wuhan, China at the end of December 2019, causing symptoms such as fever, cough, and shortness of breath in infected people; It is the new coronavirus disease. (Ministry of Health, 2020)
The main mode of transmission of COVID-19 is through droplets and contact. Schools are risky in terms of COVID-19 transmission, as they are places where there are public places. (Ministry of Health, 2020)

Distance Learning

Moore (1973) defines distance education as teaching methods in which the communication between the teacher and the learner is facilitated by printed, electronic, mechanical and other means, and the teaching behaviors are separated from the learning behaviors. (Gökmen, Smoke, Horzum,2016)

Concepts such as distance education, distance education, distance learning, simultaneous learning, flexible learning are concepts used to complete an education process where the student and teacher are physically separate.(Gökalp, 2021)

Holmberg (1995) emphasizes that distance education encompasses various forms of study where planning, guidance, teaching is done, students and teachers are not required to be together in places where lectures are held or similar, and the student is not under the control of the teacher. (Gökmen, Smoke, Horzum,2016)

EBA and EBA TV

EBA is a web-based network that offers educational and social content designed by the General Directorate of Innovation and Educational Technologies under the Ministry of National Education.
All teachers and all primary, secondary and high school students in Turkey can access EBA. In order to increase the equality of opportunity, EBA TV broadcasts were started on March 23, 2020, in agreement with TRT, different in primary, secondary and high school levels.

Hybrid Education Model

Hybrid, Coexistence of two different power supplies (Turkish Language Institution).

The hybrid education model is defined as the development of the traditional education method by combining it with online education materials. Courses such as geography, physical education, history, life sciences and art will be distance education. Classes will be divided into two. One group will go to school on Mondays, Wednesdays, and Fridays, while another group will go to school on Tuesdays, Thursdays, and Saturdays." (Selcuk, 2020).

Basaran, M, Dogan, E , Karaoglu, M , Sahin, E . (2020). In his study titled "A Study on the Efficiency of Distance Education as a Result of the Coronavirus (Covid-19) Pandemic Process", it was stated that the case study model, which is a qualitative research method, was used to get the opinions of teachers, students and parents about distance education during the pandemic process, and data were collected with interview forms. .

In the research; “It has been observed that inferences have been made such as the students' inability to actively participate in the lesson, not being suitable for individual differences, problems in entering the lesson due to technical problems, infrastructure problems, lack of materials and not being suitable for equal opportunities.

Arat, T, Minister, O. (2014), in their study titled "Distance Education and Its Applications", emphasized that the technology that has been developing since 1970 has caused changes in the education system in the process and has made a great contribution to the lifelong learning model.

Gokbulut, B. (2021), in the study titled "Distance Education and Mobile Learning from the Perspective of Distance Education Students", it is said that the readiness of students who start distance education for distance education and mobile learning is wanted to be evaluated. It is mentioned that this study was carried out with 358 university students by using the quantitative methods scanning model and the data were collected with two measurement tools.

Boz Yuksekdag, B. (2020), it was stated that the study named “Perceptions Regarding Distance Nursing Education” was conducted with selected nurses working in Eskişehir. It was stated that the project lasted 24 months and different methods and techniques were used. As a result of the studies, it was stated that the perception of nurses in distance education is not high. It was mentioned that there were significant relationships among the different nurse groups. In the study, it was suggested to develop distance education programs and environments to increase nurses' perceptions of distance education. Gul, I, Arabaci, I. (2018), in the study titled “The Views of Graduate Educational Administration Graduate Students Studying with Distance Education”, it was emphasized that distance education is a model that facilitates lifelong learning. It was stated that the interview model was applied as a qualitative research method on 19 graduate students of the study.

As a result of the study, it was stated that the students preferred the program because there was no attendance requirement, and it was seen that the students presented their requests by turning them into suggestions. Kırali, F, Alcı, B. (2016), in the study titled “University Students' Views on the Perception of Distance Education”, it was stated that data were collected on 338 students with a survey model. In the study, no significant difference was found between the variables of gender and internet connection and their perceptions towards distance education, but it was stated that there was a significant difference between owning a personal computer and using the computer during the day and the perception towards distance education. Güngör, H, Çangal, Ö, Demir, T. (2020), it was stated that the study named “Learner and Teacher Views on Distance Education of Turkish as a Foreign Language” was conducted by using an interview form on 30 students and 10 teachers.

Lock, B , Guner, P . (2021), it was stated that the study named “The Opinions of Mathematics Teachers on Web-Based Distance Education in Mathematics Lessons” was conducted with 19 secondary school teachers using a semi-structured interview form. It has been observed that teachers distinguish the positive and negative sides of distance education. While the teachers expressed positive opinions on issues such as being able to deliver content quickly, low cost, and reproducibility, it was stated that the negative aspects were the inability to provide equal opportunities in education, not being able to communicate with the student and not being able to control the student. Özyürek, A , Begde, Z , Yavuz, N , Özkan, İ, “(2016). It was stated that the study named "Evaluation of Distance Education Application According to Student's Perspective" was carried out on 115 vocational school students using the descriptive survey model.

Private Turkuresin, H. (2020), it has been stated that the study named "Examination of Distance Education Applications Conducted During the Covid-19 Pandemic Period in the Context of Pre-service Teachers' Opinions" was carried out by considering different variables. Hairless, C , Grass, V. (2016), it was stated that the study named “Secondary School Students' Opinions on Eba Ders Web Site” was conducted with 181 secondary school students using a semi-structured interview form. It was said that the students' opinions were divided into positive and negative opinions. Kaynar, Kurnaz, Doğrukök, Şentürk Barışık (2020) stated that the study named "Secondary School Students' Views on Distance Education" was conducted with 565 secondary school students with a mixed method design in which qualitative and quantitative research methods were used together. Students; It has been stated that face-to-face education is more beneficial than distance education, that the broadcasts made over EBA TV are insufficient, that they experience problems while accessing the EBA website. Students; It was stated that they did not express a definite opinion about the duration of the course, the continuous continuation of distance education, and the place where the courses were held.

Doğrukök, B, Kurnaz, A, Şentürk Barışık, C, Kaynar, H. (2021), it was stated that the study named “Evaluation of High School Students' Perceptions of Distance Education in terms of Different Variables” was conducted with 402 high school students with a mixed method in which qualitative and quantitative research methods were used

together. In the study, it was stated that private school students and high school senior students had a more positive approach to distance education. Birişçi, S. (2013), it was stated that the study named "Student Attitudes and Views on Video Conferencing-Based Distance Education" was conducted with 41 university students using an attitude scale. Students stated that video conferencing courses provide the opportunity to meet people from different fields. Students are undecided in their attitudes towards distance education; It was stated that internet interruptions prevented communication with the teacher during the lesson.

In the research; Negative aspects of students not being motivated in distance education were also shared. Ranger, A , Pumpkin, K . (2020). In the study titled "Hybrid Learning Practices and Effects in Turkey: A Meta-Analysis Study", it was stated that 30 academic studies on the subject between the years 2015-2020 were selected. In the research, it was stated that the hybrid education model can provide permanence in learning and increases in academic achievement are observed. Tezcan, Uçar (2020) It was stated that the study titled "Establishment of a Web-Based Distance Education System for Mentally Handicapped Children: Application of Mathematics Lesson" was conducted on 20 students with mild mental disabilities in a primary school. It is stated that the students were divided into two homogeneous groups and the first test-post test was applied and their success levels were examined. In the study, it was stated that there was no significant difference between classical learning in the classroom and web-supported distance education in terms of student success when the teacher's condition was met. Based on this result, it has been suggested that repeat courses can be made with web-based distance education.

METHOD

In this section, explanations about the research model, study group, data collection and analysis processes used in the research are given.

Research Model

In the research, descriptive quantitative survey model was used in order to find answers to the general purpose and sub-objectives of the research. This model was preferred to examine students' cognitive and affective views about distance education and mathematics lessons.
The screening model is a model that aims to reveal the current situation or a situation that existed in the past (Karasar, 2018). In this context, a questionnaire was applied to secondary school students.

Purpose of the research

It is aimed to examine the opinions of secondary school students about the mathematics lessons taught in the distance education program, which was started by the Ministry of National Education on EBA TV broadcasts as of March 23, 2020, and on the internet software of EBA and various private companies as of August 31, 2020, due to the Covid-19 epidemic.

Sub-Aims of the Research

1- What are the opinions of secondary school students about the mathematics lesson with distance education?
2- Do the opinions of secondary school students about the distance education mathematics course differ according to their genders (girls, boys)?
3- Do the opinions of secondary school students about the distance education mathematics course differ according to their grades (5th grade, 6th grade, 7th grade, 8th grade)?
4- Do the opinions of secondary school students about the distance education mathematics lesson differ according to the number of siblings (1-2, 3-5, 6 or more)?
5- Do the opinions of secondary school students about the distance education mathematics course differ depending on whether they have their own study rooms or not?

Importance of Research

Mathematics is the most important phenomenon that needs to be learned and interpreted for the development of science and technology. The importance of mathematics education stems from the unlimited need for mathematics itself.

Universe and Sample

The universe of the research; It consists of secondary school students from selected schools from the provinces of Manisa, İzmir, Muğla, Antalya, Şırnak and Bitlis. The students in the selected universe and sample were selected according to easy accessibility. The sample of the study, on the other hand, was formed from randomly selected students in the school by choosing one school from each of the districts of Manisa/Soma, İzmir/Gaziemir, Muğla/Bodrum, Antalya/Alanya, Şırnak/Cizre, Bitlis/Mutki. In the sample, there are 286 students randomly selected from public schools in the mentioned districts.

Table 1 Population, Sampling Frequency and Percentages

	FREQUENCY	PERCENTAGE
Girl	148	51,7
Male	138	48,3
5th grade	63	22,0
6th grade	49	17,1
7th grade	79	27,6
8th grade	95	33,2
1-2 siblings	182	63,6
3-5 siblings	85	29,7
6 Or More	19	6,6
I Have My Own Study Room	208	72,7
I Don't Have My Own Study Room	78	27,3
Total	286	100,0

According to Table 1, among the students whose opinions were evaluated in the questionnaire; The percentage of female students is 51.7% (148 people), while the percentage of male students is 48.3% (138 people). Students; 22% (63 people) are 5th grade students, 17.1% (49 people) are 6th grade students, 27.6% (79 people) are 7th grade students, 33.2% (95 people) is an 8th grade student. Students; 63.6% (182 people) have 1-2 siblings, 29.7% (85 people) have 3-5 siblings, 6.6% (19 people) have 6 or more siblings. From students; 72.7% (208 people) have their own study rooms. 27.3% (78 people) do not have their own study room.

Data Collection Tools

In accordance with the general purpose and sub-objectives of the research, the scale developed by the researchers was prepared for the students to examine the opinions of secondary school students about the mathematics course with distance education. Alpha reliability of the prepared scale was 0.86. For the validity of the scale, the opinions of 3 experts from the field were taken, the factor analysis of the scale was made, the unsuitable items were removed from the scale and it was decided to apply it by transforming it into its current form. In order to divide the research into sub-objectives, there are 4 questions in the previous personal information section of the scale (gender, class, number of siblings, own study room). 19 questions were prepared in order to examine the cognitive and affective views of the students about the distance education mathematics lesson. A four-point Likert type (Strongly Agree, Agree, Disagree, Strongly Disagree) was applied for 19 items. “Scale” has been prepared in a web-based (Google Form) environment due to pandemic conditions and easy accessibility. The scale, which was prepared in the web environment, was first conveyed to the teachers. The teachers in the selected provinces conveyed the scale to their students via web services.

Data Collection

After the web-based scale to be applied for the research to be carried out was shared with the selected teachers in the selected provinces, the scale was shared and applied with the students over the web base. The scale was left open to be answered for two days. The answers of the scale completed by each student are automatically recorded in the system of the web-based service (Google Form). After the completion of the scale filling period, the data were transferred to the computer as a file in the web environment. The information transferred to the computer environment was evaluated.

Analysis of Data

Statistical data were calculated for the frequency, percentage values and analysis of the quantitative data of the study. Quantitative calculations were made with the Statistical Package for Social Sciences 2017 (SPSS) software. T-Test and Analysis of Variance were performed for the data.

The data obtained with the SPSS program were converted into tables and graphics so that the sub-objectives of the research could be interpreted more easily. Separate calculations were made for each sub-objective of the study. Likert options on the program; It was coded as “Strongly Agree=4, Agree=3, Disagree=2, Strongly Disagree=1”. Among the 290 secondary school students who returned to the scale, the answers of 286 students were found to be evaluable. The rate of evaluation of students who returned to the scale is 98.6%.

RESULTS

In this section, the findings related to the sub-objectives of the research are given.

Findings of the First Sub-Aim

What are the opinions of secondary school students about the Mathematics lesson with distance education? This section contains the findings of the first sub-goal.

Table .2 Percentage and Frequency of Students' Opinions on Distance Education

		ABSOLUTELY I AGREE	I AGREE	I DO NOT AGREE	I STRONGLY DISAGREE
1. In the distance education mathematics lesson, I have problems during the lesson due to internet connection problems.	**N**	70	112	76	28
	%	24,5	39,2	26,6	9,8
2. I can access the lessons in the distance education mathematics lesson.	**N**	94	136	43	13
	%	32,9	47,6	15,0	4,5
3. I started to understand the mathematics lesson better in the mathematics lesson with distance education.	**N**	31	53	124	78
	%	10,8	18,5	43,4	27,3
4. My motivation is high in the distance education mathematics course.	**N**	40	93	105	48
	%	14,0	32,5	36,7	16,8
5. Mathematics subjects are processed faster in distance education mathematics lessons.	**N**	38	136	82	30
	%	13,3	47,6	28,7	10,5
6. In the distance education mathematics lesson, I can see more mathematics questions during the lesson.	**N**	55	132	76	23
	%	19,2	46,2	26,6	8,0
7. After the transition to distance education, my math performance increased.	**N**	24	49	127	86
	%	8,4	17,1	44,4	30,1
8. After switching to distance education, my interest in mathematics did not change.	**N**	51	122	84	29
	%	17,8	42,7	29,4	10,1
9. After switching to distance education, my interest in mathematics did not change.	**N**	28	80	127	51
	%	9,8	28,0	44,4	17,8
10. I still prefer distance education if there is a face-to-face education opportunity.	**N**	17	24	79	166
	%	5,9	8,4	27,6	58,0
11.Uzaktan eğitimle yapılan matematik dersinde daha fazla özen gösteriyorum.	**N**	37	116	96	37
	%	12,9	40,6	33,6	12,9
12. I have trouble presenting math homework to the teacher in the distance education math lesson.	**N**	35	57	137	57
	%	12,2	19,9	47,9	19,9
13. In the distance education mathematics lesson, the subjects stay in my mind more.	**N**	21	43	134	88
	%	7,3	15,0	46,9	30,8
14. In the distance education mathematics lesson, I get distracted while listening to the lesson.	**N**	70	127	54	35
	%	24,5	44,4	18,9	12,2
15. In the distance education mathematics lesson, I can easily communicate with the teacher during the lesson.	**N**	75	124	54	33
	%	26,2	43,4	18,9	11,5
16. I can think faster while looking at the screen (computer, phone, tablet, etc.) during the distance education mathematics lesson.	**N**	21	76	125	64
	%	7,3	26,6	43,7	22,4
17. After the distance education started, I like the math class more.	**N**	21	58	124	124
	%	7,3	20,3	43,4	29,0
18. If each student is given a computer or tablet for the distance education mathematics lesson, the mathematics lesson will be more efficient.	**N**	122	114	38	12
	%	42,7	39,9	13,3	4,2
19. Distance education is more effective than face-to-face education.	**N**	16	12	88	170
	%	5,6	4,2	30,8	59,4

According to Table 2, “I have problems during the course due to internet connection problems in the distance education mathematics course.” Percentage of those who said "Strongly Agree" to the item 24.5% (70 people), Percentage of those who said "I agree" 39.2% (112 people), Percentage of those who said "I do not agree" 26.6% (76 people), Percentage of those who said "Strongly Disagree" 9.8% (28 people).

“I can access the lessons in the distance education mathematics course.” Percentage of those who said "Strongly Agree" to the item 32.9% (94 people), percent of those who said "I agree" 47.6% (136 people), Percentage of those who said "I do not agree" 15% (43 people), Percentage of those who said "Strongly Disagree" 4% ,5 (13 people). “I started to understand the mathematics lesson better in the mathematics lesson with distance education.” Percentage of those who said “Strongly Agree” 10.8% (31 people), Percentage of those who said “I agree” 18.5% (53 people), Percentage of those who said “I do not agree” 43.4% (124 people), Percentage of those who said “Strongly Disagree” 27.3% (79 people). “I still prefer distance education if there is a face-to-face education opportunity.” The percentage of those who said “Strongly Agree” to the item 5.9% (17 people), the percentage of those who said “I agree” 8.4% (24 people), the percentage of those who said “I do not agree” 27.6% (79 people), the percentage of those who said “Strongly Disagree” It is 58%. (166 people). “My motivation is high in the distance education mathematics course.” The percentage of those who say “Strongly Agree” to the item 14% (40 people), the percentage of those who say “I agree” 32.5% (93 people), the percentage of those who say “I do not agree” 36.7% (105 people), the percentage of those who say “I strongly disagree” 16% ,8 (48 people). “Mathematics subjects are processed faster in distance education mathematics lessons.” Percentage of those who said "Strongly Agree" to the item 13.3% (38 people), percent of those who said "I agree" 47.6% (136 people), Percentage of those who said "I do not agree" 28.7% (82 people), Percentage of those who said "Strongly Disagree" 10.5% (30 people). “In the distance education math course, I can see more math questions during the course.” Percentage of those who said “Strongly Agree” 19.2% (55 people), Percentage of those who said “I agree” 46.2% (132 people), Percentage of those who said “I do not agree” 26.6% (76 people), Percentage of those who said “Strongly Disagree” 8% (23 people). “After transitioning to distance education, my math success increased.” The percentage of those who said “Strongly Agree” to the item 8.4% (24 people), the percentage of those who said “I agree” 17.1% (49 people), the percentage of those who said “I do not agree” 44.4% (127 people), the percentage of those who said “Strongly Disagree” 30.1% (86 people). “My interest in mathematics did not change after I switched to distance education.” The percentage of those who said "Strongly Agree" to the item 17.8% (51 people), the percentage of those who said "I agree" 42.7% (122 people), the percentage of those who said "I do not agree" 29.4% (84 people), the percentage of those who said "I strongly disagree" 10.1% (29 people). “I take more mathematics courses in distance education than other courses.” The percentage of those who said "Strongly Agree" to the item 9.8% (28 people), the percentage of those who said "I agree" 28% (80 people), the percentage of those who said "I do not agree" 44.4% (127 people), the percentage of those who said "I strongly disagree" 17% ,8 (51 people). “I pay more attention in the mathematics lesson with distance education.” Percentage of those who said “Strongly Agree” to the item 12.9% (37 people), Percentage of those who said “I agree” 40.6% (116 people), Percentage of those who said “I do not agree” 33.6% (96 people), Percentage of those who said “Strongly Disagree” 12.9% (37 people). “I have trouble presenting math homework to the teacher in the distance education math class.” Percentage of those who said “Strongly Agree” 12.2% (35 people), Percentage of those who said “I agree” 19.9% (57 people), Percentage of those who said “I do not agree” 47.9% (137 people), Percentage of those who said “Strongly Disagree” 19.9% (57 people). “In the distance education mathematics course, the topics stay in my mind more.” The percentage of those who say “Strongly Agree” to the item 7.3% (21 people), the percentage of those who say “I agree” 15% (43 people), the percentage of those who say “I do not agree” 46.9% (134 people), the percentage of those who say “Strongly Disagree” 30% ,8 (88 people). “In the distance education math lesson, I get distracted while listening to the lesson.” Percentage of those who said "Strongly Agree" to the item 24.5% (70 people), percent of those who said "I agree" 44.4% (127 people), Percentage of those who said "I do not agree" 18.9% (54 people), Percentage of those who said "Strongly Disagree" 12.2% (35 people). “In the distance education mathematics lesson, I can easily communicate with the teacher during the lesson.” Percentage of those who said "Strongly Agree" to the item 26.2% (75 people), Percentage of those who said "I agree" 43.4% (124 people), Percentage of those who said "I do not agree" 18.9% (54 people), Percentage of those who said "Strongly Disagree" 11.5% (33 people). “I can think faster while looking at the screen (computer, phone, tablet, etc.) during the distance education math lesson.” Percentage of those who said "Strongly Agree" to the item 7.3% (21 people), percent of those who said "I agree" 26.6% (76 people), Percentage of those who said "I do not agree" 43.7% (125 people), Percentage of those who said "Strongly Disagree" It is 22.4% (64 people). “I like math more after distance education starts.” The percentage of those who said "Strongly Agree" to the item 7.3% (21 people), the percentage of those who said "I agree" 20.3% (58 people), the percentage of those who said "I do not agree" 43.4% (124 people), the percentage of those who said "I strongly disagree" It is 29% (83 people). “If each student is given a computer or tablet for the distance education mathematics lesson, the mathematics lesson will be more efficient.” The percentage of those who said “Strongly Agree” to the item 42.7% (122 people), the percentage of those who

said “I agree” 39.9% (114 people), the percentage of those who said “I do not agree” 13.3% (38 people), The percentage of those who said “Strongly Disagree” 4.2% (12 people). “Distance education is more effective than face-to-face education.” The percentage of those who say “Strongly Agree” to the item 5.6% (16 people), the percentage of those who say “I agree” 4.2% (12 people), the percentage of those who say “I do not agree” 30.8% (88 people), the percentage of those who say “Strongly Disagree” 59.4% (170 people).

Findings of the Second Sub-Aim

Do secondary school students' views on mathematics course with distance education differ according to their genders (girls, boys)?

Table 3. T-test results on whether there is a difference in the opinions of male and female students in the sample about mathematics courses in distance education

Students	**N**	**X**	**D.F**	**t**	**Severity Level**
Girl	148	46,1149	284	,475	,726
Boy	138	45,7101	283,709		

F.D..=284

According to the data in Table 3, there was no significant difference between the thoughts of girls and boys according to the results of the t-test on whether there is a difference in the thoughts of the students about the distance education mathematics lessons. (t 475, P>.05 .726). (Girl: X: 46.11, Boy X: 45.7)

Findings of the Third Sub-Aim

Do secondary school students' opinions about distance education mathematics lesson differ according to their grades (5th grade, 6th grade, 7th grade, 8th grade)?

This section contains the findings of the third sub-goal.

Table 4. The results of the ANOVA test on whether there is a difference in the opinions of the students according to the classes they are in.

	Sum of Squares	Fd	Mean Square	F	P
Between groups	480,769	3	160,256	3,177	,025
Within groups	14224,382	282	50,441		
Total	14705,150	285			

According to Table 4, the significance value between the classes is sig<0.05 (significant differentiation)

According to the results of the ANOVA test, it was observed that there was a significant difference between the classes, since the significance value was Sig.<.05.

Table 5. LSD test on whether there is a difference in the opinions of the students according to the classes they are in.

(I) Class	(J) Class	Sig.
5th. Class	6th. Class	,052
	7th. Class	,125
	8th. Class	,002
6th. Class	5th. Class	,052
	7th.Class	,540
8. Sınıf		,410
7th. Class	5th. Class	,125
	6th. Class	,540
	8th. Class	,093
8th. Class	5th. Class	,002
	6th.Class	,410
7. Sınıf		,093

According to Table 5

- Between 5th and 6th grades sig>.05
- Between 5th and 7th grades sig>.05
- sig<.05 (significant differentiation) between 5th grade and 8th grade
- Between 6th and 7th grades sig>.05
- Between 6th grade and 8th grade sig>.05

- Between 7th grade and 8th grade sig>.05

According to the results of the LSD test, the significance value was found to be Sig.<.05 only between the 5th grade and 8th grade students. For this reason, it was observed that there was a significant difference between the views of the 5th grade students and the 8th grade students.

Findings of the Fourth Sub-Aim

Do secondary school students' opinions about distance education mathematics lesson differ according to the number of siblings (1-2, 3-5, 6 or more)?

This section contains the findings of the fourth sub-goal.

Table 6. ANOVA test results on whether students' views change according to the number of siblings"

	Sum of Squares	Fd	Mean Square	F	P
Between groups	122,148	2	61,074	1,185	,307
Within groups	14583,002	283	51,530		
Total	14705,150	285			

According to Table 6, sig.>.05 between the groups according to the number of siblings of the students. According to the obtained ANOVA test results, it was seen that the students' views did not create a significant difference according to the number of siblings, since the significance value was Sig.>.05.

Findings of the Fifth Sub-Aim

Do secondary school students' opinions about the distance education mathematics course differ depending on whether they have their own study rooms or not?

Table 7. T-test results for the difference in the opinions of male and female students in the sample about whether they have their own private study desks for distance education mathematics courses.

Students	**N**	**X**	**F:D**	**t**	**Importance level**
Yes	208	46,28	6,42	,1,402	,142
None	78	44,94	8,87		

F:D =284

According to the data in Table 7, there were no significant differences between the thoughts of girls and boys according to the results of the t-test on whether the students have their own study desks for distance education Mathematics lessons. (t 402, P>.05 .142). (Yes X: 46,24, No X: 44,72)

Discussion, Conclusion and Recommendations

In this section, the results obtained by discussing the research and recommendations are given.

Argument

In the answers given by the students to the survey items; As seen in the research of Kilit, B, Güner, P. (2021), they can access the lessons in distance education mathematics lessons, the lessons can be processed faster and the content can be presented faster, they have the opportunity to see more questions, while presenting (submitting) homework to their teachers and They expressed a predominantly positive opinion that they did not have any problems while communicating with their teachers during the lesson. It was seen that the distribution of positive and negative opinions was close to each other in the answers given to the item stating that the motivation of the students was high while they were teaching with distance education. Students; Güngör, H, Çangal, Ö, Demir, T. (2020) also found that they had problems with the internet during the lesson, as in their research.

In the study carried out by Kaynar, Kurnaz, Doğrukök, Şentürk Barışık (2020), it is predominantly found that students prefer face-to-face education with a high percentage, the efficiency of distance education is low in our country, the lessons cannot be taught effectively and face-to-face education is more effective than distance education. The results show parallelism with the research. Whether the research results differ according to gender is an important sub-objective in the researches. In our country where coeducation is carried out, the difference in the views of male and female students on education is an important issue that should be taken into account in the education programs to be implemented. When examining whether there is a difference in opinions according to gender differences, it is revealed that female students and male students do not increase their success in distance education courses, they have problems during the lesson due to internet interruptions and they prefer face-to-face education. In the distribution between the opinions of female and male students, Kaynar, Kurnaz, Doğrukök,

Şentürk Barışık (2020) and Gökbulut, B . (2021), no significant differentiation was observed as in the studies. In the study, it was observed that there was a difference between the classes. 5th grade students stated more positive views towards distance education. In the research conducted by Kaynar, Kurnaz, Doğrukök, Şentürk Barışık (2020), the fact that students with a high love for school gave more positive answers than other students can be attributed to the fact that younger children give positive results due to their high commitment to school. Basaran, M, Dogan, E , Karaoglu, M , Sahin, E . (2020) When the number of siblings increases, it is seen that they cannot attend every lesson with distance education due to technological inadequacies. This situation is possible not only in distance education but also in face-to-face education due to the physical conditions at home. In the study, it was seen that there was no significant difference between the number of siblings in mathematics courses in students' access to distance education. In the statement of MEB (2021) on distance education, it was emphasized that the number of siblings was an important factor and emphasized that this was one of the most important criteria in tablet distribution studies. Every student should prepare the working environment well in order to increase success in education. Order and silence in the working environment are important factors for the understanding of the lesson.

In the study of Kaynar, Kurnaz, Doğrukök, Şentürk Barışık (2020), it was stated that students in their own rooms, without anyone else, were more efficient in distance education, but no information was given that they had their own rooms. As a result of the research, there was no significant difference in the views of the students who have their own room and the students who do not have their own room about the distance education mathematics course.

Conclusion

A questionnaire was applied to the students in order to examine the opinions of the secondary school students about the mathematics course taught with distance education. Sub-objectives were created for the enlargement of the study area of the research and the data obtained were distributed to sub-objectives. When we examine the negative aspects of distance education and mathematics course for students from the data obtained; It was determined that they could easily attend the mathematics lesson, but they had problems due to internet interruptions during the lesson, their negative views on understanding the lesson better, their success in the lesson did not increase with distance education and their interest in the lesson did not change, the subjects were not remembered and their attention was distracted quickly during the lesson, and they did not find the mathematics lesson effective with distance education. weighs heavily. The majority of girls and boys are of the opinion that they can communicate easily with their teachers during the lesson and do not have any problems while getting and submitting their homework. Students, tablets, computers, etc. to each student. He thinks that if it is distributed, the lessons will be more productive. It was seen that the percentage of positive opinions and the percentage of negative opinions were close to each other from the opinions of female and male students about the high motivation during the lesson. In the analyzes made on the answers given to the questionnaire items, no significant difference was observed in the views according to gender. When the data obtained from the 5th grade students were analyzed; The opinions that they can easily access the mathematics lesson but have problems during the lesson, that distance education does not increase their success, that the lessons are not remembered, that they are distracted, and that distance education is not effective are more dominant in percentage.5. When the motivation of the students during the lesson was analyzed, it was seen that the motivation was high in percentage. The negative opinions of 6th grade students about understanding the lesson better and their negative opinions about their high motivation during the lesson are higher in percentage. The opinions expressed in the items other than these items are similar to the opinions expressed by the 5th grade students. It has been observed that the positive opinions of the 7th grade students regarding the item "I am distracted during the lesson" have a close percentage with the negative opinions. Negative views on better understanding of the lesson outweigh the percentage. Opinions on other items are similar to the opinions expressed by the 5th grade students. The percentages of positive and negative opinions given by 8th grade students to the item "I have trouble due to the internet during class" are close to each other. It was observed that negative opinions were higher in the opinions they expressed about the items that they understood the lesson better and that their motivation was high during the lesson. Opinions on other items are similar to the opinions expressed by the 5th grade students.

Considering the number of siblings of the students, when the answers they gave to the questionnaire were analyzed, it was seen that there was no significant difference in the overall questionnaire. In the analysis of the answers, it was seen that the views of the students did not differ significantly according to the number of siblings. When the answers of the students who had their own study room and those who did not, to the questionnaire items were analyzed, it was seen that there was no significant difference.

Suggestions

In the research, the views of secondary school students about distance education and mathematics lesson were examined. In the data obtained, the views of the variables of "gender, class, number of siblings, individual study

room facilities" on nineteen items were examined and presented in tabular form. The information obtained in this research can be used as a reference in new studies on the subject. In the analyzes made, it was seen that the motivation of the students during the lesson was generally high. In order to use this positive situation, teachers can be advised to use methods that will appeal to more senses during the lesson. One of the most dominant opinions of the students is that by ensuring that technological products such as tablets and computers reach all students, the lessons will be more productive when equal opportunities are created. In distance education, as in face-to-face education, it is believed that productivity will increase when equal opportunities are increased. The study was carried out in predetermined provinces. It can be suggested that the research be done as a regional comparison by selecting schools from each region.

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Online Courses of Mathematics for Entrance Exams

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ABSTRACT
This paper deals with the results of students during the preparing courses of mathematics for entrance exams at an university. These courses take place every year and since the Covid-19 period, they are not only face-to-face, but also online. The study involves students of secondary schools who apply to the university of economics. This report compares results of tests of two different classes of these students and from different parts of mathematics. These tests are in the form of online quizzes. We do not prove if there are differences between the scores of students of short-time or long-time courses. In addition, we compare the results with the students from the year before. We also emphasize the more problematic topics of mathematics.
Keywords: entrance exams, on-line courses, mathematics, online quizzes

INTRODUCTION

During last years, we noticed the decreasing level of knowledge of mathematics between students who had registered at universities. There was the big slump during the Covid-19 period as well. The marking of school-leaving exams from mathematics had been set more lenient than in previous years. Thus, now many universities try to increase the level of knowledge of students and prepare some courses for students. There are two types of courses, short-term or long-term. The short-term courses take place often during the summer or September. And the long-term courses often take place during the same school years when students prepare for the school leaving exams.

In this article, we discuss these courses which take place at the Prague University of Economics and Business (PUEB). The Department of Mathematics prepare courses of mathematics which increases the possibility of success of students during the entrance exams. Since to be accepted at some of the bachelor programmes, students have to gain 100 % of points from the tests (mathematics, foreign language and other subject depending on their field of study). Thus, these courses are very helpful even for excellent students.

During the pandemic period, we started to offer these courses in on-line version. And now, we continue with this trend and students can choose on-line courses as well as face-to-face courses at the university.
After accepting at university, students of all bachelor programmes have to pass an exam from Mathematics. This implies the importance of entrance exams. The course of Mathematics consists of linear algebra and mathematical analysis. See the syllabus:

- propositional and predicate logic,
- matrix algebra, rank of a matrix, determinants, systems of linear equations,
- limits and their basic properties,
- derivative of the function of 1 and 2 variables and their applications,
- integral calculus of one variable,
- differential equations.

These topics play an important role in economics applications. For the more detailed content of the course see Klůfa (2019). The examples of final exam can be seen in the textbook Otavová and Sýkorová (2020). In addition, Klůfa (2017) compared the results of students during the entrance exams depending on the type of the faculty and Otavová and Sýkorová (2016) investigated differences in results of exams of mathematics obtained by students of different faculties.

In Glivická (2020) and Glivická (2019), it is described the beginning of on-line teaching period at PUEB. At our university, we used MS Teams and Zoom for teaching, as in many other schools, see for example Barry et al. (2020), Pal et al. (2020).

During the on-line teaching period we had to face some problems. Between the more important problems for teachers fell the lack of the necessary hardware and no previous experiences with online teaching. In addition, teachers had only very short time to convert all their materials in online form. On the other hand, students had to

face learning individually and took responsibility and learned on their own without supervision. Despite these problems, students mentioned in the university survey that they would prefer other study resources then textbooks and use video tutorials during their self-study time in the non-online period as well.

To conclude, we can mention some foreign research about the online teaching. For example, in Dhawan (2020), they discussed this situation in India together with deprivation due to social class, ethnicity, etc. This topic was important in the Czech Republic as well, because not every family had at home enough computers or some additional equipment such as camera, microphone, tablet. Bozkurt et al. (2020) claimed that students would not remember the educational content delivered but how they felt during this period. On the other hand, Ananga et al. (2017) mentioned, already before the pandemic period, that the learning online required varying of pedagogy and practice to ensure effective learning outcomes.

THE COURSES OF MATHEMATICS

In academic year 2021/22, we offered on-line as well as face-to-face courses of mathematics for students who would like to pass the entrance exams at PUEB. Students could choose from seven possibilities (terms) of these courses. Four of these courses were on-line. The courses are 32, 40 or 52 hours long.

Long-term courses started during October and November. Short-term courses started in January or March.

In this paper, we deal with the entrance exam courses which takes 52 and 32 hours. The longer course started in November 2021 and finished in April 2022. The second one course started in January 2022 and finished in May 2022. Both courses were taught in on-line form. Every week there was one lesson which takes 2 academic hours. The courses included the following topics:

- expressions processing,
- linear and quadratic equations and inequalities,
- systems of linear equations,
- arithmetic and geometric sequences,
- exponential and logarithmic functions, equations and inequalities,
- trigonometric functions and equations,
- complex numbers,
- combinatorics,
- analytical geometry,
- word problems.

We used the platform MS Teams to teach and distribute materials. Students followed how the teacher solved some examples and then they have the possibility to ask questions and to solve some problems themselves.

The problem with the lack of personal contact with students, we solved using the interactive quizzes. Thus, we tried not only to teach, but to involve the students and to avoid that they get bored, or they will not understand and feel shame to ask.

INTERACTIVE QUIZZES

At the end of almost every lecture, students had to fulfill an interactive quiz. It usually contained five problems from the discussed topic, and questions had a time limit.

We used online interactive real-time voting software Mentimeter to create these tests. Mentimeter is a presentation software from a Swedish company. It is used to create presentations with real-time feedback. We built interactive presentations with the online editor. We added questions, polls, quizzes, slides, images and more to create fun and engaging presentations. The audience used their smartphones or computers to connect to the presentation where they can answer questions. The teacher was able to visualize their responses in real-time to create an interactive experience. It helped to break the ice. We encouraged the students to pass these tests and then to speak about the problems they had had. On the other hand, they were able to see the comparison with other students. Then they could think about their knowledge.

Quizzes obtain problems with open-ended and closed-ended questions. To answer an open-ended question, students had to write a number. And to answer a closed-ended question, students had to choose from a distinct set of pre-defined responses. See some examples of these questions in Pasáčková (2022).

When all students had answered or the time limit had ended, then the teacher as well as students saw the right answer and number of answers for all possibilities. At the end of the quiz, we saw the leaderboard. And the winner

was the one who had calculated the fastest and with the less mistakes. Students could use nicknames, so the evaluation was anonymous.

THE STUDY

Students fulfilled quizzes differentiated by the topic. There were 18 quizzes in the course which took 52 hours and 14 quizzes in the course which took 32 hours. There were 69 students in the longer course and 63 in the short-term course.

These tests were very helpful for getting feedback from students and to see if there were some problems with any topics. The success rate was influenced by the time limit of quizzes as well. Average time for calculating one test was 20 minutes and almost every quiz had 5 (or 4) questions.

The success rate of each quiz, it means how many percent of students wrote the right answer, is shown in Table 1. These two groups have same questions in the tests, thus we highlighted in the table which group was more fruitful.

Table 1: Comparing of success rates of the long-term and short-term courses.

Comparing of success rates	**average success rate in the course of**	
Topic	**52 hours**	**32 hours**
expressions processing	42%	46%
linear equations and inequalities	43%	35%
linear and quadratic equations	54%	-
quadratic equations and inequalities	53%	51%
irrational equations	41%	-
equations with absolute value	58%	47%
exponential equations and inequalities	53%	54%
logarithmic equations and inequalities	43%	38%
exponential and logarithmic equations with absolute value	60%	66%
systems of equations and inequalities	44%	45%
arithmetic sequences	36%	59%
geometric sequences	62%	-
trigonometric functions	36%	26%
trigonometric equations	55%	-
complex numbers	53%	73%
Combinatorics	50%	34%
analytical geometry	56%	47%
word problems	35%	21%

Students of the long-term course were more successful in 8 quizzes and the others in 6 quizzes.
All students had biggest problems with word problems. This topic is usually the most problematic, because there is not any specific way how to solve all these problems. They can encounter problems which they can easy solve by the systems of equations, or using percentage, or problems about common work, some problems about areas and volumes etc.

The second problematic topic are trigonometric functions. This topic is always one of the most complicated at secondary schools and it is often hated by students, since they have to remember many formulas, graphs and values of these functions. Many students have problems with this topic.

On the other hand, between the more successful quizzes we can mention quizzes with the topic of exponential and logarithmic equations, equations with absolute value, complex numbers and sequences,

As we see in Table 1, there are not any big differences between these two courses. We would like to proof if there is a difference between the rates of the longer course and the short one. We used the two sample t-test at

significance level $\alpha = 0.05$.

The null hypothesis was:

H_0: There are not any differences between the score of the quizzes of the two groups.

We calculated the test statistics

$$t = 0{,}288.$$

The p-value is 0,776. Since this p-value is not less than our significance level $\alpha = 0.05$, we fail to reject the null hypothesis. We do not have sufficient evidence to say that the scores of the quizzes between these two courses are different.

To compare these results with the results of students from the previous year, we can see in Pasáčková (2022) that the highest success rate in 2021 had the quiz about the linear and quadratic equations and inequations and then the quiz about exponential equations and inequations, and complex numbers. Thus, there is not any big difference this year.

The lowest success rate in 2021 was in quizzes about trigonometric equations and sequences. Thus, as we mentioned above, students had every year problems with trigonometric functions. We can see only difference with the topic sequences, in which were students this year more successful.

Now, we can compare more detailed only quizzes, where was the difference between success rates of two groups more than 10 %. It was in the following five topics, see Table 2. In addition, it is highlighted in which questions were the biggest differences between the success rates.

Table 2: Comparing of success rates of each question in both groups.

Comparing of success rates		**success rate of each question**					**average success rate of the test**		**difference between success rates**
Topic	**Type of the course**	**question nr. 1**	**question nr. 2**	**question nr. 3**	**question nr. 4**	**question nr. 5**			
equations with absolute value	52 hours	48%	73%	70%	47%	52%	58%		11%
	32 hours	41%	72%	50%	50%	20%		47%	
arithmetic sequences	52 hours	25%	32%	19%	60%	44%	36%		23%
	32 hours	50%	53%	40%	67%	88%		59%	
complex numbers	52 hours	40%	50%	33%	68%	73%	53%		20%
	32 hours	57%	57%	86%	80%	86%		73%	
combinatorics	52 hours	80%	33%	77%	8%	50%	50%		15%
	32 hours	73%	36%	33%	30%	0%		34%	
word problems	52 hours	27%	25%	54%	33%	-	35%		13%
	32 hours	38%	23%	25%	0%	-		21%	

The lower success rate had, as in the previous year, open-ended questions. Students were more successful in choosing the right answer from five possibilities. In the entrance exams, there are only closed-ended questions with five possible answers. Some examples of the entrance exams are in Klůfa (2022).

For example, the question nr. 3 of the complex numbers quiz was as follows (Figure 1) and for some of the answers see Figure 2.

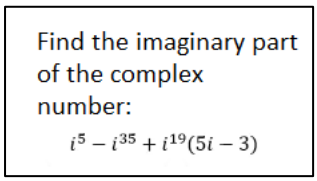

Figure 1: Question nr. 3 of the complex numbers quiz.

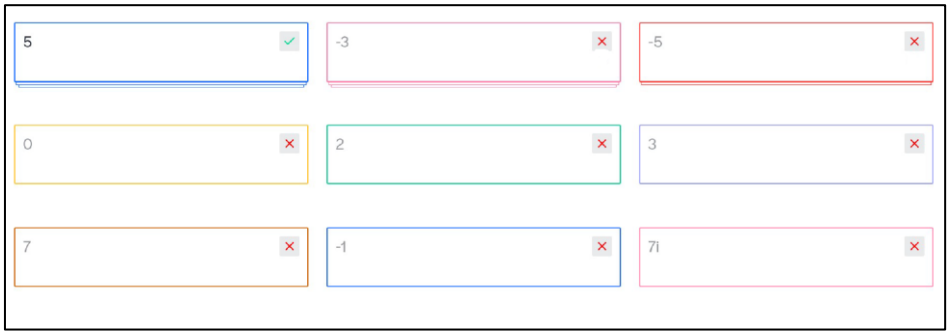

Figure 2: Few answers of question nr. 3.

To see some other questions, for example from the sequences, see Pasáčková (2022). Thanks to the feedback from these quizzes the teacher could go back to the problems which were not clear for students.

CONCLUSIONS

We did not find any big differences between the scores of quizzes of the long-term and short-term courses. As we supposed there is not any rule, that there are more clever students in the short-term course. It differs and often it depends when students get known about these courses and if they have enough time to follow these course for few months.

We can conclude with the fact that the preparing courses are for students very beneficial, the proof of it is the very high interest of these courses. Now, there is very high demand on on-line courses primarily between students from the remotely placed places from Prague.

The interactive quizzes are very helpful for teachers as well as students to find out if students understand the topic. Many students after seeing that they are not the only one who do not understand, they do not feel shame and ask and explain what the problem for them in the exercise was.
After finishing the course, students fulfilled the questionnaire about the course. The majority of students found the quizzes very useful and liked them.

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Pre-Service Teacher Perceptions on Tpack Instructional Design Micro-Course: A Case Study in the Northeastern United States

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Abstract
This case study aimed to discover pre-service teacher perceptions of a technology integration micro-course called TPACK_ID at XY University (pseudonym). The theories guiding this study were TPACK and the learner-centered education paradigm. TPACK_ID provided effective foundations for pre-service teachers to integrate technology using evidence-based technology best practices while applying 21st Century principles. This intervention combined evidence-based technology integration pedagogy, scaffolding, and a simplified instructional design model. Results demonstrated that TPACK_ID increased confidence in students' abilities to find, select, and integrate higher-order thinking educational technology applications. This single-case study used pre-course questionnaire responses from open-ended questions, course artifacts, and a post-course questionnaire's open-ended question responses. Results, implications, and future research will be discussed.
Keywords: TPACK, Triple-E Framework, simplified instructional design, teacher education, technology integration, educational technology, 21st-century learning, professional development, pre-service teacher preparation

Introduction

"Technology can amplify great teaching, but great technology cannot replace poor teaching" (Rodrigues, 2020, p. 24). Teachers must have the skills to control this tool because it will not automatically affect learning (Niess, 2017). Teachers must control and use the tool to benefit teaching, not replace teaching with technology. Technology is not an instructional strategy; it is a learning tool. Unfortunately, new teachers have little to no practical experience selecting and integrating technology. Research indicates that new teachers are not prepared to integrate technology effectively (Kopcha et al., 2020; Koh, 2018; 2019; Koh, Chai, & Natarajan, 2018; Niess, 2017; Voogt & McKenney, 2017). School districts spend millions of dollars for professional development on skills that teachers should have before entering the workforce.

Problem Statement

New teachers graduate with little to no practical experience in selecting and integrating technology. After 30 years of TPACK, PDs and teacher preparation programs do not adequately address its essential components and subcomponents (Hofer & Harris, 2019). Voogt and McKenney (2017) determined that teaching colleges do not provide pre-service teachers with technology integration experience and opportunities. Consequently, teachers lack technology integration practice, planning, and designing and confuse TPACK components favoring one over the other (Kessler & Phillips, 2019). PDs and teacher preparation courses fail to deliver authentic, intentional, active, constructivist learning that helps teachers integrate technology. These deficiencies produce ineffective teaching practices when integrating technology and limit teachers' confidence in implementing technology. Teachers' self-efficacy is a significant factor for successful technology integration (Yildiz Durak, 2021). This study aims to determine pre-service teachers' perceptions of a micro-course that combines TPACK principles, Triple E scaffolding, and CAFE's simplified instructional design (ID) model. The study investigates how pre-service teachers use an educational technology matrix that they create.

Teachers have struggled to integrate technology effectively for years, but COVID Closures exposed this deficit in technology integration skills and lack of instructional design competencies. During the Covid closures, teachers were baffled about what technology to use and how to use it (Wang, 2021). Educators struggled to organize content and what type of pedagogy they needed to embrace to deliver online and blended learning. Covid Closures impacted 1.6 billion students, or 91.3% of all learners in 194 countries (Wang, 2021). The situation left teachers dismayed and learners without sustainable and quality instruction. Covid Closures may have catapulted education

into technology, but reflection after COVID Closures provide an opportunity for education to train teachers in effective and sustainable technology integration (Kaden, 2020).

TPACK

Mishra and Koehler (2006) expanded Shulman's (1987) pedagogical content knowledge (PCK) theory to aid educators in technology integration by adding technological knowledge (TPACK). TPACK requires educators to implement technology based on how each component in TPACK influences the other and then evaluate how the infused technology impacts other components. Each component impacts the other and must work together for effective and sustainable technology integration. According to Koehler, Mishra, and Cain, 2013, the fundamental TPACK components include technology knowledge (TK), pedagogical knowledge (PK), and content knowledge (CK). TPACK subcomponents include technological and pedagogical knowledge (TPK), technological and content knowledge (TCK), and content and pedagogical knowledge (CPK). The sweet spot for technology integration is when all elements intersect and combine knowledge in technical, pedagogical, and content combinations.

Since TPACK's inception, researchers have published 3200 studies that explored and evaluated teacher TPACK competencies (Kessler & Phillips, 2019). Although the premier model for technology integration, numerous issues remain with TPACK:

- Lack of a valid, reliable, and unchallenged measure of teacher TPACK skills
- Teachers' ability to connect and relate all TPACK components when applying its principles
- Lack of longitudinal studies on TPACK's effectiveness
- Empirical evidence that TPACK positively impacts student learning outcomes, achievement, and success.
- A valid and reliable instructional design framework to assist teachers in implementing technology in their lessons while considering the lack of expertise, time, and resources
- Technocentricity (Papert [1990] coined this phrase which refers to teaching that focuses on technology and neglects learning objectives, content, and pedagogy.

A fundamental challenge in applying TPACK in the classroom is conflicting definitions of TPACK components and their importance. Willis, Lynch, Frandale, and Yeigh (2019) de-emphasized content knowledge in their study, which contradicted several original studies that stated the importance of content knowledge when integrating technology (Mishra & Kohler, 2006; Kohler, Mishra, & Cain, 2013). CK, PK, and TK should not conflict. Content and pedagogy should play an equally important role in selecting technology, but the current literature pulls these constructs apart and often argue the importance of one over the other (Harris, Mishra, & Koehler, 2009; Koh, 2018; Koh & Chai, 2016). Mishra (2019) updated the TPACK model by stressing the need for context to envelop all TPACK constructs. Many experts agree that context and pedagogy drive technology integration (Avci et al., 2020; Mouza et al., 2017; Niess & Gillow-Wiles, 2017; Rodrigues, 2020; Willis et al., 2019). Mishra and Kohler (2006) stressed that each component is equally essential, and educators must look at how they all impact each other for technology integration to be effective. Unfortunately, professional development and TPACK learning still emphasize one component or subcomponent over another.

Teacher TPACK Competencies

Research indicates teachers lack instructional design skills, experience, and confidence which is essential to weaving technology into their lessons (Koh 2018; 2019). Teachers also struggle with finding and selecting appropriate technology based on content, context, student characteristics, and culture (Neiss, 2017). Additionally, educators find aligning technology to their standards and learning objectives (Kopcha et al., 2020). Further, implementation represents educators' most significant technology challenge (Kopcha et al., 2020).

Design drives quality technology integration and implementation, which is why educators struggle with TPACK (Wang, 2020). COVID Closures exposed frustrated and confused teachers that lacked instructional design skills to guide them in transitioning to blended and online learning. A significant factor in teachers lacking instructional design skills is the lack of a validated and simplified instructional design model (Koh, 2018; 2019). New models are emerging, but validation and reliability are questionable. Koh, Chai, and Natarajan's (2018) study illustrated educators' lack of design experience and TPACK confusion. The researchers hosted a two-day workshop intervention on technology integration. The researchers found that teachers still gravitated to using technology for presenting (direct instruction) and communications rather than designing student-centered lessons that fostered creative thinking and collaboration. Teachers expressed a desire to improve reflective-, authentic-, collaborative-, and active learning with technology, yet only 1.94% of participants' lessons with technology included simulation.

Even with the workshop, the participants' lessons lacked reflection, visualization, internet searches, peer feedback, assessment, and concept analysis.

Kopcha et al. (2020) agreed that most teachers use technology for delivering and presenting content. The researcher stressed that even with TPACK training, educators need help to switch to a student-centered approach to technology and emphasize higher-order thinking with their technology integration. Koh, Chai, and Natarajan (2018) added that teachers still cannot leverage technology to enhance critical thinking and creation and depend on technology mainly for rote-learning exercises. Wang (2021) and Kolb (2019; 2020) agreed that teachers' lack of design experience would lead to inefficient and ineffective technology use.

Kopcha et al. (2020) concluded that for efficient and effective technology integration, educators must see value in technology. Willis et al. (2019) agreed that teachers must have a technology buy-in and have confidence in using it. Niess (2017) added that teachers must select technology based on learning objectives. The technology must be simple and not require significant time to learn. The user must see a benefit in using the technology, and professional development must demonstrate how to apply it, not just how to use it. PDs should include context, culture, and design. Finally, PDs must instruct TPACK to value each component equally and not favor one or subcomponent over the other.

Technology Integration

Teachers struggle to integrate technology because of time, resources, support, clear objectives, and the lack of modeling, pedagogy, and leadership (Rodrigues, 2020). Despite increasing technology knowledge (TK), teachers struggle to find and select appropriate technology (Koh, Chai, & Natarajan, 2018). Although educators know they must shift their pedagogy from teacher-centered to learner-centered, they continue to integrate technology using ineffective, teacher-centered pedagogy. Koh, Chai, and Lim (2017) contended that TPK is the weakest construct and has contributed to teachers' confusion and challenges with technology.

According to Kopcha et al. (2020), classrooms are constantly changing, so technology must be flexible. Willis et al. (2019) added that technology must be purposeful, flexible, and pedagogical, and the educator must implement it with clear expectations and objectives. Willis et al.'s (2019) study on the best technology integration predictors found that more technologically savvy teachers are more successful at aligning the technology to learning objectives, content, and context. The researchers confirmed that successful technology integration included interactive, immersive, and collaborative learning environments. According to this study, the ultimate predictor was the teacher's belief that the technology would improve student outcomes.

Various researchers recommended a technology matrix to aid educators in technology integration (Kopcha et al., 2020; Niess, 2017; Willis et al., 2019). Niess (2017) stressed providing multiple and diverse technologies to teachers and describing technologies' affordances, how they will enhance learning, create a student-centered and collaborative environment, and address students' needs and learning preferences. Kopcha et al. (2020) stressed that teachers must know their students' abilities and characteristics before integrating technology and should consider remediation before attempting to apply it. Niess (2017) added that educators should create a technology system of numerous technologies and pedagogies based on learner characteristics, learning goals, and objectives. Kopcha et al. (2020) suggested Kolb's (2020) Triple E Framework, which focuses on aligning technology to learning objectives. In addition to supplying various technologies to teachers, PDs must provide a variety of methods of delivering these technologies based on teachers' comfort levels and students' characteristics (Niess, 2017).

Professional Development and Preservice Challenges

Avci et al. (2020) observed that current TPACK and technology integration PDs were ineffective. After completing TPACK and technology integration PDs, teachers lacked resources, skills, and knowledge and had negative attitudes toward technology. The teachers tended to resist change in pedagogy and technology because the PDs focused on technology rather than instruction that uses technology to enhance learning. Willis et al. (2019) confirmed that PDs should not focus on content or be teacher-centered but should focus on the participants' needs and characteristics. Acvi (2020) argued that PDs should focus on content. Koh, Chai, and Lim (2016) agreed with Acvi (2020) that PDs should focus on content.

Papert (1990) coined the word technocentric to describe how educators get caught up in using technology and forget the original purpose and application. Avci et al. (2020) described today's PDs as technocentric. Rodrigues (2020) confirmed in his study that current technology integration PDs are technocentric. TPACK and technology integration PDs still focus on using the technology itself rather than applying it, aligning it to the learning objectives, and seamlessly weaving it into the lesson. Koh (2018, 2019) agreed that TPACK PDs are ineffective

and not taught appropriately or effectively. Koh (2020) added that PDs lack TPK success because teachers need to shift their focus away from singular TPACK components and look at how all of the components work together. PDs must guide educators on how the technology will impact the pedagogy or content. Professional learning needs to convey how pedagogy and content will affect technology. PDs need to direct educators on how each component and subcomponent impacts the other and advise educators on how to apply the technology for the most impactful learning outcomes. Koh (2020) also stressed that a one size fits all technology integration PD will fail. Educators, their students, the culture, environment, and context differ. PDs must be tailored to context, content, learning objectives, subject matter, culture, and preferred pedagogies.

According to Koh (2018; 2019), of all TPACK components and subcomponents, educators struggle the most with the technology and pedagogy intersection (TPK). Koh and Chai's (2016) quantitative study illustrated this TPK deficit which confirmed that teachers only considered TPK .95% of the time when planning lessons. Kolb (2019; 2020) agreed that teachers struggle with TPACK intersections, subcomponents, and interrelatedness. Kopcha et al. (2020) explained that educators are confused and naturally prefer one TPACK component over another rather than seeing TPACK as a unified and interdependent body. This attitude results in technocentricity and isolates the technology rather than integrating it as part of the lesson. After PDs and workshops on technology integration, teachers' perceptions of TPACK are negative because they still feel uncomfortable with new pedagogical practices which shift due to the technology. Hofer and Harris (2019) found the opposite in their study on teacher design and saw their teachers completely ignore technology. Their study found that teachers emphasized content, learner characteristics, and activities but not technology when designing lessons using TPACK to integrate technology. These results conflict with focusing on technology and disregarding everything else.

PDs have failed to shift teacher-centered learning to student-centered learning, a TPACK cornerstone. Educators feel unprepared to transfer the skills because they lack the confidence to apply TPACK principles. Koh (2018; 2019) attributed these deficits to a lack of a validated design model to integrate technology. Avci et al. (2020) agreed that technology integration PDs fail because they do not include instructional design nor tailor the PD to participants' needs, context, and characteristics. Avci et al. (2020) worried that teachers do not have enough time to play with the technology and reflect on ways to integrate it during PDs. Koh's (2018; 2019) participants also stated they wanted more time for discussion and meaningful reflection on the technology they were integrating. Further, the PDs have been unsustainable, inflexible, and lack reflection of the participant's voice. Finally, Avci et al. (2020) found that the skills did not transfer to the classroom because the PDs did not include active participation.

Mouza (2017) was one of the few researchers that addressed pre-service teacher courses on TPACK and technology integration. The researcher indicated that pre-service teachers have only a superficial understanding of using technology according to TPACK, and the American university system does not prepare pre-service teachers to find, select, align, and implement educational technology. Buss (2018) stressed that pre-service teachers must graduate with the skills to integrate technology. Students should be ready to transform learning through technology on their first day of class, but unfortunately, universities do not prepare students to do so. Kaplon-Schilis and Lyublinskaya (2019;2020;) stressed that teacher prep programs must teach effective technology integration by explaining how TPACK components interconnect. Each component has a purpose but will only work effectively if the educator considers all the other components. Niess (2017) agreed that teaching colleges in the United States do not systematically prepare teachers to integrate technology. Niess added that teacher prep programs do not address new learners' characteristics like instant gratification, visual nature, need for graphics, networking, or their propensity to gaming, multi-tasking, and active and authentic learning practices.

Buss (2018) conducted a two-year longitudinal study to measure pre-service teachers' TPACK progress. The research discovered that students graduated without TPACK competencies and lacked the skills to integrate technology effectively. Buss (2018) envisioned the problem as the teacher prep programs did not provide modeling, observing, or practicing technology integration. Students could describe TPACK but not apply it. Kaplon-Schilis and Lyublinskaya (2019;2020;) experienced similar results in their study on math teachers. They observed that pre-service math teachers felt unprepared after graduation to integrate technology.

PD and Pre-service Course Requirements

Koh, Chai, and Lim (2017) stressed that the goal of technology integration professional development is to help teachers leverage technology to improve students' critical thinking, multicultural communications, cognitive skills, innovation, problem-solving, and organizational skills. Effective technology integration learning requires three components, evidence-based andragogy, TPACK, and simplified instructional design. Figures 1 and 2 display evidence-based approaches and content for pre-and in-service professional learning.

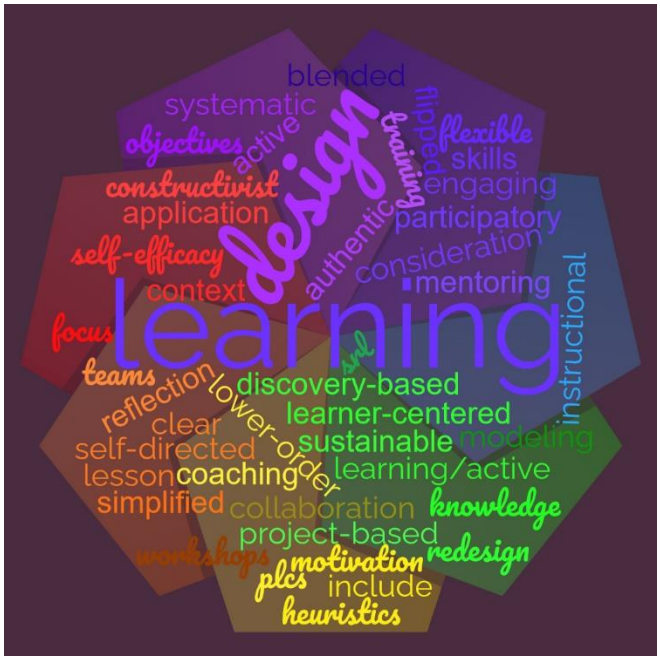

Figure 1: *Professional Development Approach for Integrating Technology*

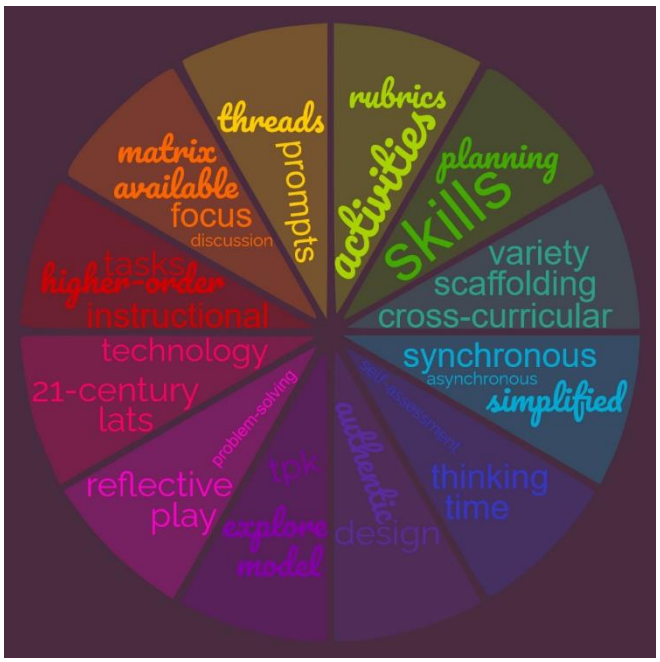

Figure 2: *Professional Development Content for Integrating Technology*

Kopcha et al. (2020) stated that an effective PD "is about supporting teachers in developing a robust perspective on what is possible with technology while improving their ability to anticipate results and successfully meet their goals in the future" (p. 742). PDs must promote active learning and higher-order thinking, measure goal attainment, provide authentic problem-solving situations, and promote collaboration (Koh, Chai, Lim, 2016). PDs must be systematic, have administrative support, have a technically strong facilitator, and address participants' context, culture, and needs (Koh, 2018; 2019). Wang (2021) added that PDs must be sustainable.

Andragogy

Andragogy originated with Knowles's adult learning theory. Teaching TPACK depends on adult learning theory's best practices, like participant-centered, sustainable, and self-directed learning (Buss, 2018). Rodrigues (2020) embraced Active Training to teach technology integration because it is dynamic, flexible, reflective, participatory, collaborative, project-based, engaging, reflective, and a flipped model. Wang (2020) suggested that adult learning should include simplified instructional design models, scaffolding, clear instructions, motivation, piloting, and chunking. Rodrigues (2020) found that PD participants experienced increased motivation and self-regulation when

the PD leveraged Active Training. Yildiz Durak (2021) also noted increased motivation when providing authentic learning opportunities, which increased transference.

Koh (2020) recognized in her research using a one-on-one model that the trainer should address different degrees of participant TPACK skills. Trainers should focus on modeling for the novice TPACK learner. PDs should offer the emergent learner a pedagogical realignment toward TCK and provide a deeper dive into TPACK for the experienced learner. Although Koh (2018; 2019) recommended collaborative learning, her 2020 study recommended individual coaching and training. This individualized learning approach conflicts with all other studies that promote collaborative learning for all professional development (Rodrigues, 2020). In Koh's (2020) study that recommended individualized training, she also recommended collaboration. Koh's (2020) preferred approach remains unclear.

Professional Development Content

PDs' content should encourage teachers to design their lessons and embrace TPACK principles while integrating technology and enhancing 21st-century learning (Koh, Chai, & Lim, 2017). Wang (2021) encouraged TPACK professional development to include online discussions, persuasive arguments, summaries, collaborative projects, synthesizing constructs, and offer synchronous and asynchronous learning options. Koh (2018; 2019) stressed scaffolding in the form of rubrics, a lesson plan rating system, guided practice, and revised pedagogy which would improve teachers' TPACK confidence. Lee and Kim (2017) added that scaffolding improves teacher self-efficacy and shifts pedagogy from teacher-centered to student-centered learning.

Harris, Mishra, and Koehler (2009) First introduced learning activity types (LATs) to improve technology integration. Rodrigues (2020) asserted that LATs should include quiz builders, concept maps, flashcards, Facebook page creation, website creation, digitizing worksheets, and e-Books. Digitizing worksheets and flashcards conflict with many researchers because these activities only use technology rote learning functions (Reister & Rook, 2021). This lower-order thinking is counter-intuitive to 21st-century skills (Chai, Hwee Ling Koh, & Teo, 2018; 2019).

Design heuristics and a simplified instructional design model are essential to effective TPACK PDs. After their study, Koh and Chai (2016) demanded that TPACK include another knowledge component, design knowledge (DK). The design must include context, student characteristics, learning objectives, content, and tasks. Wang (2021) argued that PDs must include a simplified instructional design model because teachers do not have the skills, training, or practice in the instructional design field. PDs must consider the lack of skills when introducing design into PDs.

Wang's (2021) simplified instructional design model includes content, activities, facilitation, and evaluation (CAFÉ). Suggested content should be systematic, organized into modules, straightforward, and presented with an outline or table of contents. Activities should include LATs and have clear instructions all streamlined on the LMS. Facilitation encompasses learner-learner and learner-instructor engagement, regular and various communications, and a regular instructional time or calendar of events. Further, the instructor should group students by demographics, skills, and content area. Finally, educators should leverage the LMS platform's evaluation options and include peer evaluations, assignments, formative quizzes, and summative assessments.

It is interesting to note that Koh, Chai, and Lim's (2017) study on TPACK-21C interventions demonstrated positive results in all domains except math. These results correspond with Kaplon-Schilis and Lyublinskaya's (2019;2020) study on integrating technology with math teachers. The two studies agreed that math instructors' confidence and skills are lacking when integrating technology. Koh, Chai, and Lim's (2017) study that included design, self-regulation, collaboration, and reflection positively impacted most teachers. The intervention showed that clear pedagogical goals improved learning outcomes, and collaboration, discovery-based learning, and design-by-learning increased teacher confidence in integrating technology. The researchers noted that their rubric parameters should have been more explicit, and their participants lacked content knowledge. Koh's (2020) study also highlighted learning by design as a valuable component of TPACK skills building and technology integration.

Triple E and CAFÉ Frameworks

Kolb (2019; 2020;) stressed that technology could not stand alone. The researcher developed a framework for educators that includes scaffolding and pedagogy that addresses TPACK challenges. Wang (20201) observed the lack of design elements for teachers that TPACK needs for successful technology integration. Combining the Triple E and CAFÉ frameworks could provide educators with a clear, simplified, and time-saving way to weave technology into lessons while considering all primary and secondary TPACK components.

Triple E

Triple E consists of three equally important elements, engagement, enhancement, and extension. Engagement involves time on task, valuable, not distracting technology, and technology that supports social learning. Enhancement includes higher-order cognitive skills, selecting technology that makes learning more straightforward, not more complicated, and technology that adds value to the lesson. Finally, extension describes how technology should humanize learning, including P21 skills building, and how it needs to connect learners to authentic, meaningful, contextual, and culturally relevant learning experiences.

Engagement means students are actively learning with technology, not distracted by it. To promote engagement, educators must have clearly defined learning objectives and provide opportunities for students to be social. Kolb (2019; 2020) leverages andragogy and TPACK PD strategies for effective technology integration using these principles of engagement. Engagement emphasizes social learning, which addresses evidence-supported andragogy, including peer-to-peer collaboration, participatory learning, motivation, exploratory- and discovery-based learning (Avci et al., 2020; Buss, 2018; Koh, 2020; Koh, Chai, & Lim, 2016; Koh, Chai, & Natarajan, 2018; Niess, 2017; Rodrigues, 2020). Kolb (2019; 2020) suggests the following specific strategies to foster engagement:

- Turn and talk
- Partnering
- Visible thinking routines
- Reflection
- Modeling
- Think, pair, and share
- Turn and teach

Kolb cautions practitioners with evaluating engagement, stressing that time on technology is not equivalent to time on task. The best measure of effective technology is the student's level of engagement in achieving the learning objective. Time on task trumps time on the device.

Kolb (2019; 2020) encourages practitioners to choose technology based on collaboration and social affordances. Bells and whistles are insignificant and can be a distraction to learners. Instead, technology should encourage collaboration and social interaction. If technology does not have all these affordances, Kolb advises that educators can still use it. Still, they must adjust their approach to facilitate collaboration and social learning.

Enhancement encourages the practitioner to ask, *Does technology add value to traditional learning methods?* Technology should simplify and streamline learning, not make it more complicated (Kolb, 2019; 2020). Technology should enhance learning by offering new perspectives or ways to reach learning goals and fostering 21st-century skills. Enhancement also means the technology should encourage exploration, questioning, and discovery and foster differentiation and critical thinking. Educators must select flexible technology that provides scaffolding for the learning objectives. Educators should provide clear instructions on the purpose and usage of the technology so the focus remains on attaining learning goals. Finally, for technology to enhance, it must be able to personalize learning. According to Kolb (2019; 2020), if educators see value in technology that does not possess these attributes, they can still use it; they need to adjust their approach (TPK).

The final component of TPACK, extension, capitalizes on ways technology transfers learning outside the classroom (Kolb, 2019; 2020). Research indicates authentic learning aids transfer (Buss, 2018; Koh, Chai & Natarajan, 2018; Niess, 2017; Yildiz Durak, 2021). The Triple E framework embraces authentic learning LATs. Contextual learning also encourages transfer (Koh, 2020). This third component proves ways to foster contextual learning. Enhancement also involves flexibility, scaffolding, clear learning goals, higher-order thinking, and multiple rubrics to encourage extended learning with technology (Kolb, 2019; 2020).

Kolb (2019; 2020) stresses that educational technology should be free, accessible on all devices, and bridge learning from the classroom to the home. Technology should personalize the learning experience and humanize the learning. As with engagement and enhancement, if the technology possesses only some of these extension attributes and educators see value in it, they should adapt their pedagogy to use the technology.

Unfortunately, only one study validated the Triple E Framework and is not peer-reviewed. Schatzke's (2019) dissertation validated Kolb's (2017) rubrics to confirm if the rubrics aided instructors in using appropriate educational technology tools. The study also determined the Triple E framework's rubric reliability. Results were positive and provided evidence that the Triple E rubrics were valid and reliable. Unfortunately, no other known peer-reviewed studies exist regarding implementing the Triple E framework in pre-service coursework. This

research also limited the evaluation to iPads and did not consider other forms of educational technology. Further research needs to occur to gain insights into Triple E's impact on pre-service teachers and apply it to various technologies.

CAFÉ

Kolb's (2017) Triple E framework provides scaffolding and technology integration guidance, but Wang's (2021) CAFÉ adds a simplified instructional design process that TPACK lacks. CAFÉ stands for content, activities, facilitation, and evaluation. Wang (2021) recommends that instructors systematically organize their lessons' content for easy access and flow. The researcher suggested organizing content for lessons into modules on an LMS and aligning additional resources with the main content. Wang (2021) also recommended providing a concise list of lessons, course content, and location.

Activities correlate to TPACK's LATs and include reflective, productive, synchronous, and asynchronous activities (Wang, 2021). Wang stressed that LATs' instructions must be clear with obvious learning objectives. Finally, Wang (2021) recommended piloting the LATs before initiating them.

Facilitation refers to peer-content, peer-peer, or instructor-peer delivery of instruction (Wang, 2021). The researcher suggested frequent and various communication methods and regular virtual office hours for students. The researcher also advised instructors to establish regular instruction times for consistency. Finally, instructors should create learning groups to foster collaborative learning.

Evaluation, the final CAFÉ element, should include the LMS assessment. Evaluation should include peer evaluations, graded assignments, projects, and participation ratings. Wang (2021) also suggested formative quizzes and summative assessments.

Given the various research, a clear design gap exists when applying TPACK principles of technology integration (Koh, 2018, 2019). Teachers lack time, resources, experience, and practice to use effective instructional design techniques to create lessons. Although Wang's simplified instructional design model shows promise for educators, the researcher could only provide anecdotal evidence. Further qualitative and quantitative research must determine the framework's effectiveness. Further, no research on this simplified instructional design model exists for pre-service teachers, nor does any evidence exist on potential synergies between the Triple E and CAFÉ frameworks.

Gap in Research

Several gaps and conflicts exist in recent literature. One conflict is the disagreement regarding TPACK definitions and components' weight. The discord creates confusion among educators and course developers. Further, Chai (2018; 2019) uncovered challenges with validated instrumentation to measure pre-service teachers' perceptions of TPACK. Teachers' perceptions determine the success of integrating TPACK principles and transferring skills to the classroom.

Additionally, existing TPACK instruments are self-reports and only measure participants' confidence, not TPACK competencies (Kaplon-Schilis & Lyublinskaya, 2019;2020;). Kaplon-Schilis and Lyublinskaya (2019;2020;) agreed with Koh (2020) that current instruments that measure TPACK have questionable validity and reliability. Kaplon-Schilis and Lyublinskaya (2019;2020;) suggested that the current studies measure each TPACK component rather than applying technology using all components succinctly. A mere measure of individual components does not give a researcher the data to determine educators' TPACK competencies.

Koh, Chai, and Natarajan (2018) noted a lack of comparative studies on TPACK PDs, pre-posttest TPACK interventions, longitudinal data on PDs, and incorporating context. Saubern, Henderson, Heinrich, and Redmond (2020) recommended the following additional research: (a) how teachers transfer TPACK skills to the classroom; (b) how teachers collaborate on technology integration; (c) how metacognition improves teaching and learning with technology; (d) how teachers organize technology-related projects; and (e) how multidisciplinary TPACK improves teaching and learning.

Most research has covered in-service professional development courses, but the literature lacks TPACK undergraduate pre-service courses. All but one study on university TPACK and technology integration courses are at the graduate level. Further, none of the pre-service or in-service studies included student learning outcomes or longitudinal data (Saubern et al., 2020). Saubern et al. (2020) lamented the lack of research on TPACK's application and how it transferred to the classroom. No studies included the time it takes for teachers to design programs or methods they use to design lessons for integrating technology. The body of literature also lacks data on how teachers find, select, align, and apply technology (Kopcha et al., 2020). Koh (2018; 2019) stated that TPACK and technology integration research to date is inconclusive.

Another gap in the literature includes a lack of research on effective simplified instructional design models. Wang (2021) and Kolb (2020) present educators with a simplified instructional design model for integrating technology; however, little evidence exists regarding their impact. Koh (2018; 2019) contended that no validated design model exists to help teachers integrate technology. Koh is the only researcher to provide validated evidence on scaffolding and using rubrics to teach TPACK. In her study, Koh (2018; 2019) admitted that she did not differentiate scaffolding, did not account for student preferences, domains, and design heuristics, and did not develop LATs according to context. In all, further research needs to occur regarding the impact of a TPACK intervention that includes a simplified instructional design model.

Research questions

Central RQ

What are undergraduate pre-service teachers' perceptions of a technology integration micro-course based on TPACK and the Triple E and CAFÉ frameworks?

RQ1

What are undergraduate pre-service teachers' perceptions of using a technology matrix they synthesize with their peers (authentic, collaborative, and participatory learning)?

RQ2

What are undergraduate pre-service teachers' perceptions of using a simplified instructional design process?

RQ3

What changes in attitude on technology and lesson design did pre-service teachers experience after taking the micro-course?

Methodology

A single-case study was appropriate for this investigation because the investigation required a granular group of participants with specific characteristics. Researchers chose purposeful sampling techniques because the population required specific characteristics. (Stake, 2004). The participants needed to be undergraduate education majors with no field experience. Participants also were taking their first education course, so they had no prior academic experience with lesson planning, pedagogy, or applying content.

Researchers collected qualitative data from the open-ended questions on the pre-course questionnaire, weekly discussion group threads, comments from the technology matrix, and the post-course questionnaire's open-ended questions.

All participants were enrolled in XYU's Spring 2022 semester's EDUC XXX introductory course in the foundations of education and had no prior field experience or had worked with TPACK or ID. Participants submitted a questionnaire on demographics and any prior experiences with TPACK concepts. Before starting the micro-course, students took a pre-test to determine TPACK and ID knowledge and skills. Upon completion, participants initiated the six-week asynchronous micro-course. After finishing the micro-course, participants completed a summative post-test aligned with the pre-assessment. Students also submitted a post-course questionnaire reflecting their experiences in the course. D2L served as the platform for all communications, instruction, and assessments.

Ethical considerations

Both researchers have CITI certification and had no financial or other outside benefits from conducting this study. Participants did not receive any financial reward for participating in the study.

Participants

Upon IRB approval, researchers submitted participation requests to 72 students in two Educ XXX courses at XY State University (XYSU). Initially, 34 students signed consent and submitted the pre- TPACK_ID questionnaire, and 24 finished the micro-course and took the post-course survey. Sophomores comprised 48% of the participants, followed by 29% first-year students, 14% juniors, and 9% seniors. English and social studies dominated the subject area with 43,% followed by middle-level education (29%), math and science (23%), music and art (9%), and global languages (3%). Most students resided in the Midatlantic state where XYSU is located, and Educ XXX was the first education course most students had taken.

Development of course

This micro-course aimed to equip pre-service teachers with TPACK and a simplified instructional design model so they can develop blended, hybrid, and online classroom content with fidelity. Evidence has demonstrated teachers' challenges with grasping TPACK and applying it, so the micro-course leveraged two powerful frameworks, Kolb's (2017) Triple E technology integration framework and Wang's (2021) simplified instructional design model CAFÉ. XYSU provided the LMS, D2L, to host the micro-course, and the students took TPACK_ID coinciding EDUC XXX. The learning objectives of the six-week asynchronous intervention were:

- Using TPACK, Triple E, and CAFÉ, students will find and select a minimum of two educational technology applications that will add value to their content and pedagogical approach to a lesson of their choice.
- Students will align these educational technology applications to state and ISTE standards and learning objectives.
- Students will incorporate appropriate evaluation tools leveraging technology to confirm that their students will have achieved the learning objectives.
- Students will align technology, LATs, and assessment to learning outcomes, content, context, and culture and use student-centered pedagogy that fosters critical thinking and 21st-century skills.

The micro-course adhered to evidence-based best andrological practices, including providing multiple communication options and regular updates in the form of news and announcements (Niess, 2017; Yildiz Durak, 2021). The course built upon lower-level skills, which used explicit teacher-centered strategies and leveled up to higher-order thinking tasks that demanded collaboration, creation, and synthesis (Buss,2018; Koh, Chai, & Natarajan, 2018; Niess, 2017; Yildiz Durak, 2021). LATs were authentic, relevant, participatory, and explicit instructions with clear learning objectives (Avci et al., 2020; Buss, 2018; Koh, 2020; Koh, Chai, & Lim, 2016; Koh, Chai, & Natarajan, 2018; Niess, 2017; Rodrigues, 2020).

Course content

Before students could log into the course, they took a pre-course survey which included demographics and questions regarding students' educational experience, educational technology, and course design. The course lasted six weeks and consisted of an estimated two hours per week to review course content and complete the LATs. On Thursday of each week, the course required students to answer a discussion group prompt. On Sunday, the students responded to at least two peers. The students followed the parameters of the discussion group rubric.

Each week of the course contained one module and followed a consistent outline:

I. Welcome and overview of the week's module
II. Review of the last week's content
III. Pre-test of course content
IV. Introduction to new content
V. LAT(s)
VI. Discussion group thread
VII. Post-test

The instructor provided announcements and regular feedback using videos, emails, instant LMS messages, and the LMS announcement system. Students needed to create a one-hour lesson plan within their domain that incorporated a minimum of two educational technology tools. Students also collaborated to synthesize a matrix of technology that became a working document within the course and was available using Google Sheets. Students shared ideas and exchanged valuable information on the technology they had used before or had seen and were classified by domain and recommended grade.

Module 1 & 2

Module 1 welcomed students to the course with a video from the instructor explaining the course expectations and objectives. Students introduced themselves and shared what they wanted to accomplish by taking this micro-course. Module 2 focused on TPACK's foundations and definitions. By the end of the module, students had to identify each primary and secondary TPACK component and explain the intersections and alignments. Students had to start visualizing their lesson and brainstorming ideas for a one-hour lesson incorporating at least two educational technology tools.

Module 3: The Triple E Framework
By the end of this module, students needed to identify Triple E's main components and explain how to adapt technology that had value but did not meet all the Triple E requirements according to the rubrics. LATs included simulations of students applying various instructional strategies that would enhance educational technology. The Triple E presentation included an interactive video using Edpuzzle to increase student engagement. Students also read about available instructional technologies and ways to foster student-centered learning.

Module 4: Analyze & Design
Before introducing students to Wang's (2021) simplified instructional design model, students needed to have an introduction to the foundations of instructional design and its implications for technology. By the end of this module, students needed to find appropriate educational technology for their lesson, evaluate their technology selections and compare them, and align them to the learning objectives they identified for their lesson. Students updated the collaborative educational technology matrix. Students should connect the design process to lesson planning and educational technology.

Module 5: Instructional Design CAFÉ
In this lesson, students identified components of CAFÉ and described the simplified instructional design process. The students aligned TPACK, The Triple E framework components, and CAFÉ's design process to develop their lesson plans. Students created a rough draft of their lesson. The instructor presented the fundamental content in the form of an interactive presentation. Students collaborated on the technology matrix and shared their rough draft lessons for peer review.

Module 6: Reflection
Students reviewed TPACK, Triple E, and CAFÉ concerning their lesson, two of their peers' lessons, and reflective discussion group questions. Students also took a summative assessment equivalent to the pre-tests given throughout the micro-course. Finally, students completed a post-course questionnaire based on Chai, Ko, and Teo's (2019) instrument to measure TPACK competencies for 21st-century learning. The researchers adapted this instrument to reflect the American language and courses offered at universities' education departments.

Data collection and analysis
Out of the 34 participants, 24 remained throughout the study. Data were collected before, during, and after the micro-course. Participants submitted data from (a) a pre-course questionnaire with open-ended questions; (b) discussion group comments; (c) a participant-created technology matrix; (d) a pre-test taken before each module; and (e) a post-course questionnaire including open-ended questions.

Researchers used Atlas.ti qualitative data analysis software to improve objectivity and trustworthiness. The researchers uploaded 94 documents to the software program and created 187 codes, 511 quotations, one memo, and seven networks. Researchers employed a deductive process of coding (Denzin & Lincoln, 1994). Following Stake's (1995) recommendation of direct interpretation, researchers used Atlas.ti to conduct multiple coding iterations, themes and patterns emerged, creating commonalities regarding students' perceptions of TPACK, ID, and the Triple E framework.

Findings

This study described pre-service teacher perceptions of the TPACK_ID micro-course. The data demonstrated that pre-service teachers' perceptions of their ability to find, select, and integrate technology into a lesson exceeded their expectations. Further, the Triple E framework of scaffolding and the simplified instructional design model empowered the participants to become designers of their lessons which aligned with the research (Avci et al., 2020; Koh, 2018; 2019; Koh, 2020; Mishra and Koehler, 2006; Wang, 2021).

Theme 1 Teacher Pre-Post Course Perceptions
Pre-service teacher TPACK perceptions before the course were scattered. Table 2 displays the differences in opinions on TPACK components.

Table 2: *Pre-Course TPACK Perceptions*

Student TPACK Component Preference	TPACK Attitude
CK most important	2
CPK	1

PCK	2
PK	4
TK	2
TPACK components are equally important	11

Note: *n*=22; data from two participants is missing.

Before the course, 11 students believed the TPACK components were of equal value, but the other half displayed a bias for one or more of the components or subcomponents. Most students who did not envision all TPACK components working together believed pedagogy was the more critical element when integrating technology. Pricilla explained,

> I believe the most important component of TPACK is pedagogy. You must have a good preferred instructional strategy to get your students engaged. If you know your content, but your pedagogy is boring, or your students do not understand the content, you must reevaluate and find different ways to connect the students with content.

PCK and CK were also more critical to four other students than the overall equal value of TPACK components. Benjamin argued for CK,

> I believe that content knowledge is the most important component of TPACK. I believe that content is most important because to have effective teaching and to know what technology best fits your classroom, a teacher must be a borderline expert in their field. When you have so much knowledge about a certain topic, I feel as though teaching that topic could become second nature over time. For example, before technology (in modern society, social media, computers, etc.) a good teacher would be a teacher that could effectively teach content knowledge solely based on prior understandings of said knowledge. In today's classrooms, content knowledge is enhanced by using technology to help understand the pedagogy.

Post-course results were resounding. Figure 3 shows the results of students' TPACK attitudes after the six-week micro-course.

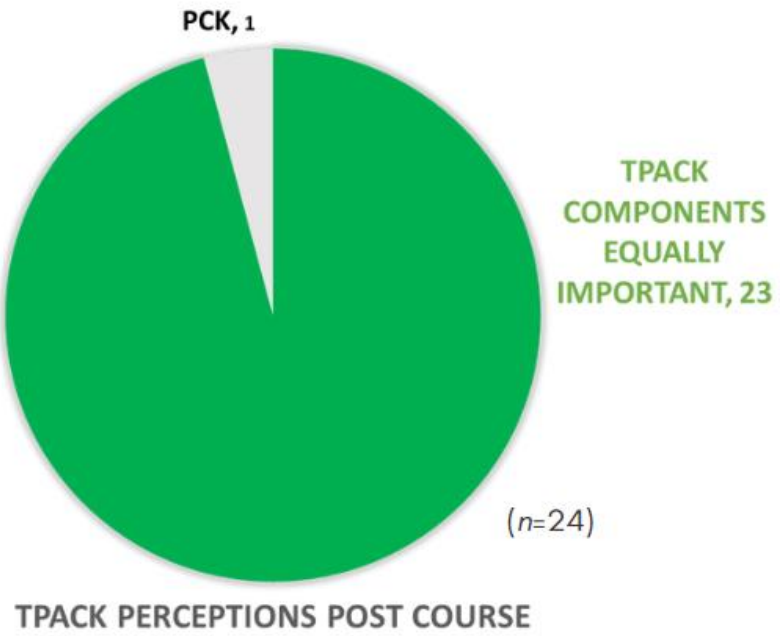

Figure 3: *Post-Course TPACK Attitudes*
Note: *n*=24. Post-course data includes two additional students.

All but one student valued TPACK components equally. John best described the class' consensus,

> I think TPACK itself is going to benefit me after learning about it. Understanding the simple fact that there is a sweet spot and that TPACK is interdependent makes me realize that you need to perfectly design the content technology for the students. If you don't ensure that your pedagogy, content, and technology are all working together properly to inform your students, then one of them could be hurting the other. And the students will not come to grasp with the content as well.

This attitude from most students conflicts with the extant research lamenting that pre-and in-service teachers can identify each component of TPACK but view each component as a separate entity rather than working together (Hofer & Harris, 2019; Kessler & Phillips, 2019; Voogt and McKenney, 2017).

Only one student argued that pedagogical content knowledge was more significant in applying technology to the classroom. His argument was compelling, and he presented evidence from Mishra and Koehler (2006) that could be interpreted as content and pedagogy being more critical than the technology because he stated that the technology needs to be applied based on pedagogy and content; however, what he missed was that pedagogy and content also rely on technology.

Figure 4 represents students' thoughts regarding leveraging TPACK and employing a simplified instructional design model in their lesson plan development.

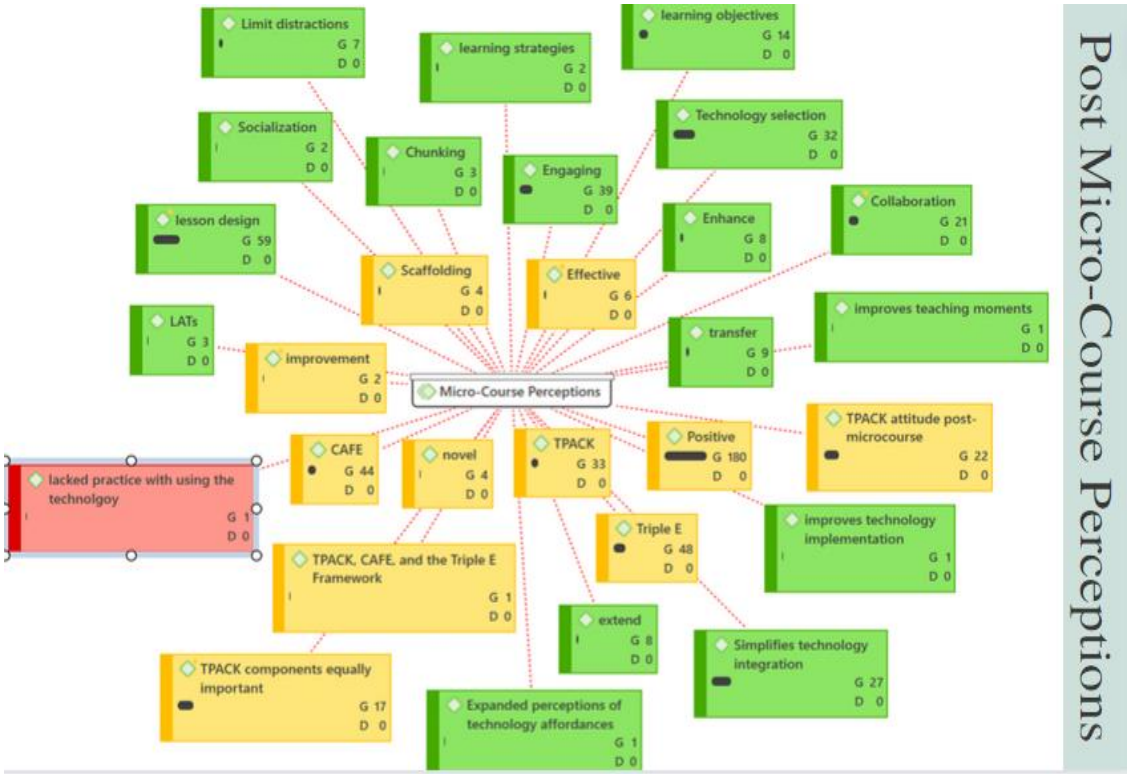

Figure 4: *Teacher TPACK and ID Perceptions Post-Course*

Most students believed they could design a lesson with the new skills they obtained through the micro-course. The research produced 180 positive quotes on the micro-course and its elements and one negative quote. Hope explained,

> This micro-course definitely improved my skills on integrating technology into lesson plans because I didn't know half of the websites, simulators, and other tech stuff that my peers mentioned and throughout each video or document given to us. I thought I knew a lot about technology and how I can use it for teaching, but this micro-course showed me wrong to be honest.

The participants stated they were confident in selecting technology, could apply elements of the simplified design process, and integrate the selected technology. This positive and confident attitude conflicted with the research

that indicated pre-and in-service teachers lack the confidence and skills to design lessons (Buss et al., 2018; Kaplon et al., 2019; 2020;)

John believed the Triple E framework would verify that the educational technology he selects would be appropriate and effective,

> The idea of Triple E Framework will be very valuable for my pre-service teaching education. I feel this way because each segment within it: engage, enhance, and extend, is all clear-cut ways to determine if your technology will benefit your students.

Participants believed they could leverage technology to make the lesson engaging, improve collaboration and socialization, and align their tasks and technology to the learning objectives. Claire expounded,

> This micro-course improved my skills on integrating technology into lesson plans by giving me some better understanding of how technology can be incorporated in teaching and how it could still keep students to be engaged with their peers, as well as learn more about the certain subject being taught.

Students valued their new skills of aligning TPACK to learning objectives and strategies and were confident these new skills would enhance learning. Multiple participants noted a new awareness of the possibilities of technology being a distraction. Finally, students saw value in using chunking to improve learning. Daniel explained, "This micro-course showed me how to incorporate different aspects of TPACK into learning objectives and how they all work interchangeably."

Theme 2: Scaffolding and Simplified Instructional Design

The most significant takeaways involved the Triple E Framework and the affordances of its scaffolding, rubrics, and templates. Figure 5 illustrates students' confidence in using their new skills.

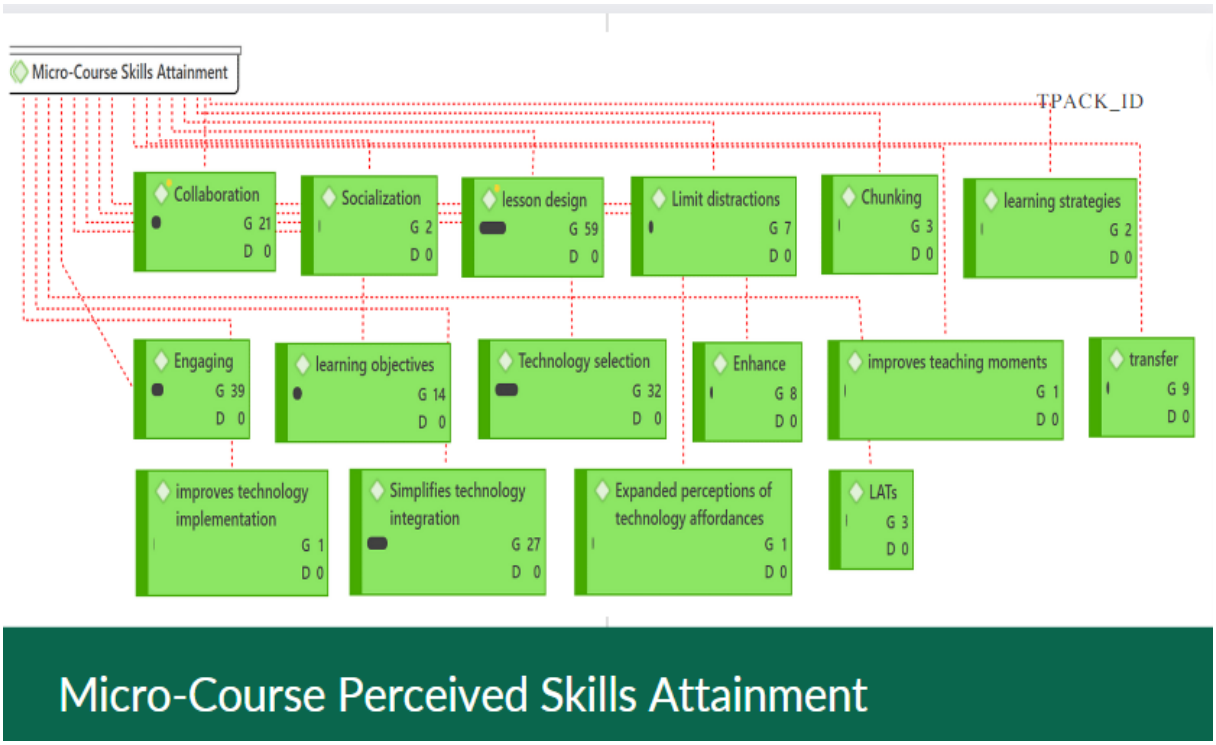

Figure 5: *Participants' Confidence in TPACK_ID Skills*

The students also highly valued the simplified instructional design model CAFE offered. Hope contributed,

> What I found to be the most interesting and valuable concepts for my pre-service teaching education is the CAFE lesson. I just found this to be so interesting, as I have never heard about it before and my mom is a teacher, but this is valuable to me because there is just so many things I can do with it, and incorporate all those aspects to a lesson.

This data negates the previous research that pre-service teachers feel unprepared to design a lesson using technology (Kolb, 2019; 2020; Koh, 2018; 2019; Wang, 2021).

Participants believed that their TPACK would improve their lesson design and plan to apply these principles when teaching. The code "lesson design" appeared 59 times in open-ended responses to students' reflections and post-course questionnaires. Rachel's response typified most of these quotes,

> There are many aspects from the design models that will improve my lesson planning. I have learned how the components of TPACK rely on each other in order to be strong and will use that make my lessons strong. I will select technology that aligns with my learning objectives.

These results align with Koh's (2020) and Wang's (2021) studies demonstrating that lesson design is a critical element of integrating technology into the classroom.

Overall perceptions of elements within the TPACK, Triple E, and CAFE frameworks were positive. The coding included 180 positive comments versus one negative comment. The only negative comment regarding the course was that there needed to be more time to practice using the technology discussed. Abigail stated, "I think if we had more hands-on work with potential technologies it would have been beneficial." The course intentionally left out explicitly teaching the technology students would be using, according to Kopcha et al.'s (2020) research. The course objectives were to provide the foundations of educational technology rather than teach how to use the technology. Given the rapid technological changes, this strategy was important so students would be empowered and capable of selecting any technology, iteration, and application (Kopcha et al., 2020). The course did encourage students to play with and become familiar with the technology, but this student wanted more time embedded in the course to learn about the technology itself. A course focusing on "how-to" is technocentric, and research shows it is counterproductive (Avci et al., 2020; Willis et al., 2019). Students learn how to use the technology but never learn how to find it, select it, and integrate it appropriately. Still, the research also states that teachers are frustrated because they do not have enough time to learn and play with the technology (Avci et al., 2020). Perhaps we need a sweet spot- a balance of using and applying technology. Further iterations of this course could provide insights into allowing more time to learn the technology during the course.

Theme 3 Types of Technology Participants Selected

The collaborative project of creating a sharable technology applications matrix provided a glimpse into the type of technology participants chose. Students demonstrated a variety of new and emerging educational technologies. The educational technology matrix listed the educational technology applications by domain and included the technology's perceived benefits. This matrix improved students' technology integration confirming the extant research (Kopcha et al., 2020; Neiss, 2017; Willis et al., 2019).

Most students who selected the lower-order thinking skills applications re-tooled them to make them collaborative, engaging, and creative and employed creative-thinking best practices (Kolb 2017; 2019). In essence, the students employed 21st-century skills by adapting lower-order thinking applications, one of the course's objectives that aligned with Koh (2018; 2019). Libby described adding a poll to a presentation to make it more interactive and engaging,

> Powerpoint is a way for students to understand that it is now time to learn, and it is also a way for students to be interactive. I can put polls up where students can vote on their phones, and I can use links to videos or games for students to play.

Libby's example of adapting lower-order thinking applications illustrates the Triple E framework's intent to re-tool educational technology to foster higher-order thinking (Kolb, 2017; 2019).

Theme 4: Pre-Service Math Teachers' Perceptions of Integrating Educational Technology

An interesting theme that emerged was the pre-service math teachers' perceptions of integrating technology. Figure 6 displays pre-service math teachers' perceptions of technology before and after the course.

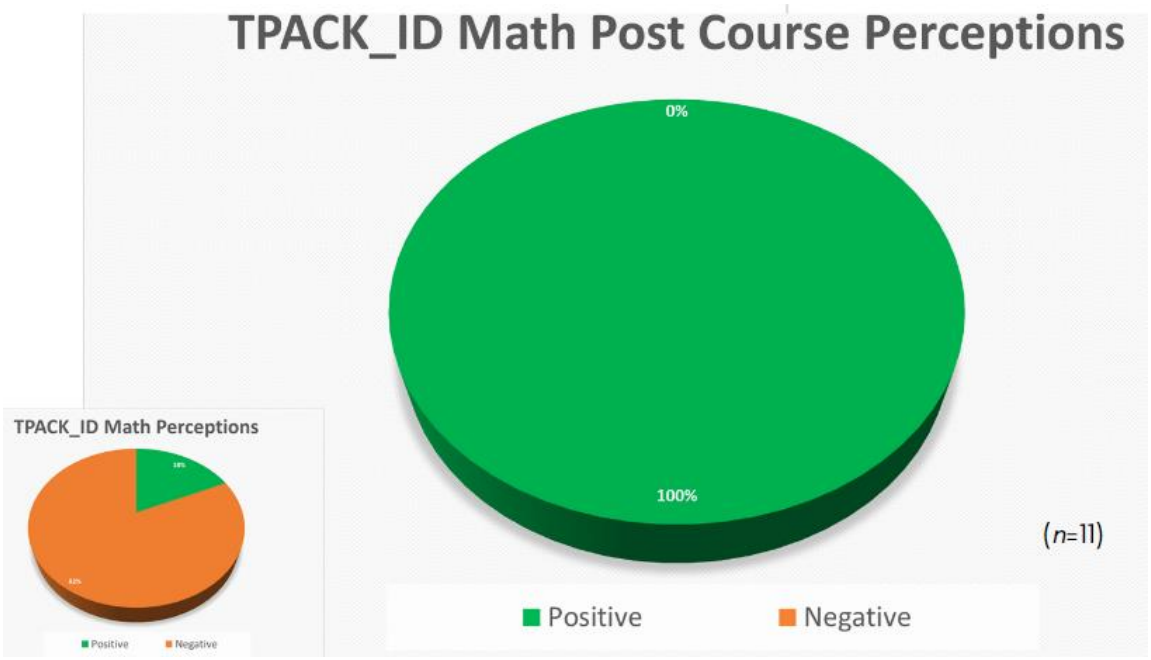

Figure 6: *Pre-service Math Teachers' Technology Perceptions Pre-Post Course*

Before this course, most math pre-service teachers had a negative attitude toward teaching with technology aligned with the literature (Kaplon-Schilis & Lyublinskaya, 2019;2020;). Students referenced using paper and pencil to teach and learn math. Abigail suggested before the course regarding adding technology, "We could use pencil and paper or type in Microsoft Word."

Students willing to integrate technology were more interested in lower-order thinking educational technology applications like digitizing worksheets, cloze exercises, and using videos to teach lessons. Ruth elaborated,

> I feel that it would be very important to use technology to make worksheets that have definitions, fill in the blanks and problems that are left blank so that when I teach I can project the worksheet onto a touch board and fill them in during lecture.

The applications pre-service math teachers promoted before the course were individual rote-learning math games like "Math is Fun." These students also cited sedentary and teacher-centric applications like Khan Academy, YouTube, Excel, and PowerPoint, which aligned with the literature (Kaplon-Schilis, & Lyublinskaya, 2019;2020;).

Phoebe noted that secondary and post-secondary math classes do not incorporate technology except for PowerPoints or videos. Phoebe continued,

> Most of my math classes have used little to no technology in any part of the semester. The teacher would have a sheet of paper with notes written down, which they would transfer to the dry-erase board, which you as a student would copy down into your notes.

Hope was vehement about using technology in the math classroom,

> I would be against anything like Ipads or chrome books, as those can be a distraction to the students unless they have blocked websites or such. For this age group, I would say a projector in the classroom would be appropriate. Math majors agreed that elementary school was too young to incorporate technology but thought middle school or secondary education would be an appropriate time to introduce technology.

This reluctance to use technology aligns with the research (Kaplon-Schilis & Lyublinskaya, 2019;2020;). Students explained that they learned math with paper and pencil; their professors still teach math with paper and pencil, and just like the literature states, they will teach the way they learn comfortably.

Post-course results were remarkable. By the end of TPACK_ID, all pre-service math teachers displayed a positive attitude regarding using technology in the classroom. Further, pre-service math teachers contributed more

educational technology applications than any other domain indicating a significant change from preferring paper and pencil to innovation. Pre-service math teachers promoted applications that empowered learners to create. Phoebe explained how one of her educational technology applications would work to help students be creative while learning math, "The student will create shapes of symmetry will be addressed in the Symmetry Artist activity on math is fun by allowing them to access a higher level of learning and actually create something."

Like the general population, the pre-service math teachers also adapted technology to incorporate 21st-century skills. Students adapted individual rote-learning educational technology games to be collaborative and played among teams. Almost all students incorporated Kahoot into their lesson plans because, as students, they enjoyed the program and found value in the gamification of learning. Elizabeth noted Kahoot would "get students thinking on their feet in a more competitive way."

Discussion

This research is significant because, empirically, little to no qualitative research exists on TPACK's transfer (Avci et al., 2020; Koh, 2020; 2019; Saubern et al., 2020). Most of the research is quantitative, and the instruments used are self-reports limiting their trustworthiness. This study provides rich and thick details on pre-service teachers' perceptions of applying these concepts to lesson plans. By incorporating the micro-course concepts into the micro-course, the instructor could model the TPACK, Triple E, and CAFE concepts the participants needed to use in their lessons. The micro-course embraced collaborative, engaging, interactive, and higher-order thinking educational technology and pedagogy displayed positive results, which aligns with the research (Avci et al., 2020; Buss, 2018; Koh, 2020; Koh, Chai, & Lim, 2016; Koh, Chai, & Natarajan, 2018; Niess, 2017; Rodrigues, 2020). Since the micro-course modeled best practices, students incorporated similar technology and pedagogy into their content area. The data confirmed the research regarding the importance of modeling, and the students' comments post-course reflected this modeling.

No research exists on an intervention that combines TPACK, evidence-based scaffolding, and a simplified instructional design model. The extant literature quantitatively and separately demonstrates that each model aids teachers with technology integration, but no research study combines the TPACK principles, scaffolding, and a simplified ID model. Research confirms the need for all elements (Kolb, 2017; Mishra & Koehler, 2006; Wang, 2021). Mishra and Koehler (2006) stressed that teachers must be designers to integrate technology effectively. This micro-course demonstrated how applying scaffolding and a simplified ID model to the TPACK principles guided pre-service teachers in creating effective lessons.

Theoretically, very little peer-reviewed research exists on an exceptional model that provides scaffolding for teachers leveraging TPACK and effectively integrating technology (Koh, 2019). No research exists on Wang's simplified instructional design model that he developed for emergency online learning during COVID. The initial responses to Wang's CAFE model were positive and encouraging.

Implications

Given the results from the pre-service math participants, elementary, secondary, and post-secondary math instructors should consider incorporating higher-order thinking educational technology applications. Modeling is important because research shows that students tend to embrace the pedagogy that helped them learn. When math students do not see value in adding technology because their previous teachers did not embrace it, the likelihood of them using technology in their classrooms diminishes.

Teaching colleges must incorporate TPACK, scaffolding, and instructional design into their curriculum. Research provides multiple ways universities can incorporate technology (Buss, 2018; Kaplon-Schilis & Lyublinskaya, 2019;2020;). This micro-course provides one way universities can provide skills coinciding with a foundation in education course. By incorporating this micro-course into a foundation of education class, professors could incorporate concepts into the main course, which would enhance learning and help students embrace technology. The micro-course also provides exceptional scaffolding, modeling, and a simplified lesson design process using technology.

Limitations of Study and Future Research

The nature of a case study is not generalizable. The study was limited to a medium-sized university with pre-service teachers in their first education course. Further investigation with universities of multiple sizes and varying levels of students is needed. Further, limited research exists on in-service teacher interventions using a combination of scaffolding and simplified ID to integrate technology. Future research should extend this study to in-service teachers.

Incomplete data and attrition were limitations of this study. Two of the participants did not submit their pre-service questionnaires. The researchers extracted their data from the discussion threads that contained similar questions. Further, many students dropped out of the study mid-way into the course due to other commitments. Some of these students were very active in the discussion threads, and rich data had to be eliminated.

Future research should focus on quantitatively measuring TPACK skills attainment. All current instruments are self-reports that lack trustworthiness. Future quantitative research should also investigate the effectiveness of the Triple E frameworks' templates and rubrics. Multiple research studies call for scaffolding, and this study provided detailed positive responses to using these rubrics and templates. Quantitative research would verify the effectiveness of Triple E's scaffolding.

Finally, further research should measure the effectiveness of Wang's simplified ID model, CAFE, and verify the one research study that validated the Triple E framework (Schatzke, E. (2019). At the time of this study, no quantitative or qualitative research verified or extended Wang's model. Schatzke (2019) was the only peer-reviewed study to validate the effectiveness of the Triple E framework, and the research was conducted on in-service teachers. Further research would validate Schatzke's (2019) research and confirm the effectiveness of a simplified ID model that pre-service and in-service teachers could effectively use to integrate technology.

Conclusion

Pre-service teachers graduate with little to no practice in integrating technology. Further, pre-service and in-service have a skewed perception of educational technology and its appropriate use. Many educators have a techno*centric* or techno*phobic* view of technology in the classroom, but few see the importance of weaving technology into the lessons. This research study suggests that by combining TPACK, the Triple E framework, and CAFE, pre-service teachers had the necessary tools to design, develop, and evaluate a lesson incorporating effective technology and pedagogy based on learning objectives. Further, TPACK_ID dispelled the technocentric attitude most teachers report by encouraging participants to design their lessons with all TPACK components working in harmony.

As the findings from the data constrained to this research uphold, combining the TPACK, the Triple E framework, and CAFE models enabled participants to consider technology, pedagogy, and content in their lesson plans. While further research will provide insights into data outside the scope of this work, these insights will prove to inform the trajectory of future data collection, research, and programmatic recommendations.

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Psychometric Properties of Smartphone Scales: Perspectives of University Students in the Kingdom of Bahrain

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ABSTRACT
Many studies have been conducted to investigate the effect of using smartphones in the teaching and learning process. The purpose of the present study was to identify the factor structure and the psychometric properties of a smartphone questionnaire. The questionnaire was translated into Arabic and administered to 203 students at a university in Bahrain. Both exploratory factor analysis and confirmatory factor analysis were used to explore the reliability and factorial validity of the Arabic version of the questionnaire. The results showed that the four-factor structure is appropriate. The findings obtained in this study indicate that the translated version of the smartphone questionnaire can be effectively used in Arabic-speaking countries.
Keywords: Confirmatory factor analysis, Mobile learning, Reliability, Smartphone.

INTRODUCTION
In recent years, technology has affected many aspects of human life, such as health, economy, politics, and educational fields. In education, smart learning is defined as learning that occurs by using mobile phones or wireless devices (Aderinoye et al., 2007). Specifically, the term smart learning or mobile learning is described as the use of smartphones or any handheld devices that are used to communicate with others, exchange information and ideas with different people in different places. Smart devices could be used positively and productively inside the classrooms.

Much research had been constructed to explore and investigate the effect of using smartphones in the teaching and learning process. For example, Melhuish & Falloon (2010) found that the use of smartphones enables learner-centered approaches as well as increases the interaction between the learner and tutor. Additionally, Valk, Rashid, and Elder (2010) stated that mobile learning is not fixed in the classroom times, instead, it could be done any time. Moreover, Hulme and Traxler as cited in Clayton & Murphy (2016) indicated that the use of mobile learning provides diverse opportunities and chances for learners to explore independent investigation.

Research was done by Cheon, Lee, Crooks, and Song as cited in Clayton & Murphy (2016) and specified that mobile learning or smart learning supported the four types of learning including individualized learning, collaborative learning, informal learning, and situated learning. To illustrate, students control their learning pace, which represents individualized learning. In addition, students and teachers easily communicate and interact with each other using smart devices which represent collaborative learning. Also, students learn outside the classroom at their convenience this represents informal learning. Finally, students use their smart devices to learn in a real-life context and in an authentic way and that refers to situated learning.

Kemp (2018) revealed that smartphones enable learners to acquire learning and innovation skills such as critical thinking, creative thinking, communication, and collaboration to a certain degree. To be specific, the use of a smartphone lead students towards being a self-reliant lifelong learner. Also, it allows them to be well prepared for the future. To create new knowledge and innovation, learners must possess the ability to ask and answer important questions, provide a critical review, generate a solution for a problem, communicate and work with others in learning (Trilling & Fadel, 2009). As Trilling and Fadel (2009) mentioned, the process of learning gets easier when learners get quick access to additional resources while they are learning in the classrooms. Accessing information through smartphones encourages meaningful communication between teachers and learners in different ways such as social media, email, and messages.

However, other research disagrees with using a smartphone in the learning and teaching process as it has negative effects. According to (Corbeil & Valdes-corbeil, 2007) using a smartphone in learning can distract students' attention and their learning because it enhances chatting with others online. Although smartphones provide various learning resources to students, it also affects students negatively by distracting their learning process, lowering their academic performance, and developing psychological problems and social problems (Singh & Samah, 2018).

Also, some research mentioned that using smartphones in learning can create a feeling of isolation especially if the student didn't have the opportunity to have a smartphone like the rest of the students which can impact the student's emotions and indirectly will impact academic achievements. More importantly, excessive usage of smartphones can affect students' health. For example, past research has indicated that using mobile phones frequently might increase brain tumors and other brain diseases (Shudong & Higgins, 2005). Also, studies had been shown that mobile phone radiation increases blood pressure (Braune et al. as cited in Shudong & Higgins, 2005). Smartphone offers many functions, but students are more attracted to chatting and searching for new friends through social media and exchanging pictures that seem to be unrelated to their learning (Lee et al., 2014).

Desmal (2017) investigated the impact of using social media such as Instagram, Facebook, Twitter, etc on academic performance among 150 students in three universities in Bahrain. The results revealed that social media has a positive effect on academic performance, and more than half of the students prefer the mobile application, WhatsApp as a social media for their academic purpose. The Gulf Daily News has reported in their 28 August 2021 issue that the Ministry of Education in Bahrain could soon allow students to bring their smartphones and other personal devices to school to optimize their learning. They have therefore set up a pilot project "Bring Your Own Device" being run in 84 government schools. It is against this backdrop, and with the hope that the use of smartphones would enhance students' learning that this study of the use of smartphones in the learning process was undertaken.

The present study explored the validation and factor analysis of a smartphone questionnaire when translated into Arabic language and administered to higher institution students in Bahrain. In addition, the degree of using smartphones by the higher institution was determined.

METHOD

Objective of the study

The objectives of the study were to:

1. Examine the reliability and validity of a smartphone questionnaire in a Bahrain context.
2. Test the factor structure of the smartphone questionnaire from data provided by a sample of Bahrain students.
3. What is the degree of using smartphones among the students in higher institutions in Bahrain through their learning process?

Participants and data collection procedures

The present study was conducted with 203 university students who were randomly selected from a university located in Bahrain. 22 of the participants were preparing for careers in Arts and Science. 67 of the participants were preparing for careers in Business and Finance, and 114 were preparing for careers in Engineering. Of these, 54 (26.6%) were males and 149 (73.4%) were females. Their mean age was 21 years.

Translation

The smartphone questionnaire was initially developed in English and was translated into Arabic using back-translation, verification, and modification methods (Ercikan, 1998). Two independent professional translators from Bahrain translated each item into Arabic and back translated the Arabic version into English.

Instrument

The instrument was divided into two sections. The first section consists of demographic variables such as gender and students' specialization in the college. The second section consists of twenty items that were divided into four categories and were used to identify the degree of using smartphones in the learning process. These categories were 4 items for the presentation of information (PI), 4 items for browsing and searching for information (BSI), 4 items for organizing the work (OW), and 7 items for follow-up and communication (FC). An example of an item from the presentation of information scale is "I follow my grades through smartphone". An example from organizing the work scale is "I organize and arrange for my lectures and tests by smartphone". Also, an example of the follow-up and communication scale is "I communicate with my course professors through the smartphone". The items were constructed using the Likert-scale format and the students responded to the statement in a five-point scale ranging from strongly agree (5), agree (4), not decided (3), disagree (2), and strongly disagree (1). Table 1 shows the construct and the corresponding Items.

Table 1. Constructs and corresponding items

Construct	**Item**
Presentation of information (PI)	
PI1	I follow up my grades through using my smart phone.
PI2	I use my smart phone to do my course evaluations
PI3	I save my courses files on my smart phone
PI4	I use my smart phone to take notes on my lectures.
Browsing & searching for information (BSI)	
BSI1	I exchange messages with my classmates through the smart phone
BSI2	I use my smart phone to search for specific topics.
BSI3	I use smart phone to follow up my assignments.
BSI4	I browse the digital libraries through my smart phone.
Organizing the work (OW)	
OW1	I communicate with my classmates through the social networks by my smart phone.
OW2	I use my smart phone to follow up the university announcements.
OW3	I organize and arrange for my lectures and tests by my smart phone.
OW4	I read and browse my course textbooks [in PDF or word formats] through my mobile.
Follow-up and communication (FC)	
FC1	I use my smartphone to follow up my email communications.
FC2	I follow up urgent messages from the university by my smartphone.
FC3	I communicate with my course professors through the smartphone.
FC4	I hold meetings with my classmates through using smartphone applications.
FC5	I use some smartphone applications to send questions or inquiries to my professors.
FC6	I use smartphone to finish my academic university tasks.
FC7	I use the smartphone to do electronic presentations.

Data Analysis

Descriptive Statistics

The descriptive statistics of the smartphone items are shown in Table 2. All mean scores were greater than 3.00, ranging from 3.41 to 3.65. This indicates an overall positive response to the constructs measured in the study. All the standard deviations (SD) were all less than 1.00, ranging from .80 to .85, indicating that the item scores were around the mean. The data were examined for multivariate normality before assessing the factor structure of the responses as recommended by Tabachnick and Fidell (2019). All the items of the mobile phone showed a skew or kurtosis value less than the cut-offs of the absolute value of 3 or absolute value of 8 respectively, as recommended by Kline (2016), and this supported the univariate normality in the items. Mardia's coefficient (a standard measure of multivariate normality) was 87.63, which, as recommended by Raykov and Marcoulides (2008), was less than p (p + 2), where p is the total number of observed indicators (for this data, p = 19).

Table 2. Descriptive statistics for the constructs

Construct	Mean	Standard deviation	Skewness	Kurtosis
PI	3.41	0.854	-0.402	0.044
BSI	3.65	0.808	-0.664	0.392
OW	3.46	0.798	-0.293	0.234
FC	3.63	0.806	-0.749	0.312

To examine the degree of using smartphones among Bahrain college students in their learning process, the mean was calculated, as well as standard deviation and ranks to the use of smartphones in their learning process for every survey category and the whole survey. Table 3 reports the mean, standard deviation, and rank of using smartphones in presentations for the information category.

Table 3. Mean, standard deviation, and rank of using smart phones in presentations for information category.

Statement number		Statement	Mean	Std. deviation	Rank	Degree of use
3		I save my courses files	2.42	0.804	1	High

		on my smart phone				
4		I use my smart phone to take notes on my lectures.	2.28	0.837	2	Average
1		I follow up my grades through using my smart phone.	2.27	0.784	3	Average
2		I use my smart phone to do my course evaluations	2.25	0.756	4	Average
		Total	2.30	0.575		Average

The above table shows that the degree of using the smartphones in the presentations of information category by Bahrain college students was in the average level where the arithmetic mean of their uses is (2.30) and the standard deviation is (0.575). Moreover, the degree of usage was between average and high, and the arithmetic mean was between (2.25-2.42). Furthermore, the highest rank was at the first statement that said, "I save my courses files on my smartphone", where the arithmetic mean was (2.42) and standard deviation (0.804). This statement showed that Bahrain college students have a high degree of using smartphones in the process of following their grades. The second rank was for the second statement which was "I use my smartphone to take notes on my lectures." which had arithmetic mean equal to (2.28) and standard deviation (0.837). This statement showed that the year-four students in Bahrain college students have a high degree of using smartphones in the process of doing course evaluation.

The third rank which is explained by the statement: "I follow up my grades through using my smartphone." had an arithmetic mean of (2.27) and standard deviation equal to (0.784). This statement showed that Bahrain college students have an average degree of using smartphones in the process of saving course files. The last rank that is for the fourth statement "I use my smartphone to do my course evaluations", had an arithmetic mean (2.25) and standard deviation equal to (0.756). This statement showed that Bahrain college students have an average degree of using smartphones in the process of taking notes during lectures.

Table 4. Mean, standard deviation, and rank of using smart phones in browsing and searching for information category.

Statement number	Statement	Mean	Std. Deviation	Rank	Degree of use
5	I exchange messages with my classmates through the smart phone	2.65	0.653	1	High
7	I use smart phone to follow up my assignments.	2.41	0.801	2	High
6	I use my smart phone to search for specific topics.	2.40	0.781	3	High
8	I browse the digital libraries through my smart phone.	2.37	0.806	4	High
	Total	2.46	0.546		High

Table 4 explains the degree of using the smartphones in the browsing and searching for information category by year-four students was in high level which had an arithmetic mean (2.46) and a standard deviation equal to (0.546). Moreover, the degree of using smartphones ranges between high and average, and the mean was ranging between (2.65-2.37). Furthermore, the highest rank was the second statement that said "I exchange messages with my classmates through smartphone" where the arithmetic mean of it was (2.65) and the standard deviation was (0.653). This statement showed that students in Bahrain colleges have a high degree of using smartphones in the process of exchanging messages with their classmates. The second rank was for the statement which states "I use the smartphone to follow up my assignments" with arithmetic mean equal to (2.41) and a standard deviation (0.801). This statement showed that Bahrain college students have a high degree of using smartphones in the process of following up on assignments.

The third rank was for the first statement which states "I use my smartphone to search for specific topics" where it had arithmetic mean that was (2.40) and a standard deviation equal to (0.781). This statement showed that Bahrain college students have a high degree of using smartphones in the process of searching for information. The last rank was the fourth statement which said "I browse the digital libraries through my smartphone" which had an arithmetic mean of (2.37) and a standard deviation (0.806). This statement showed that students in

Bahrain colleges have a high degree of using smartphones in the process of and surfing and browsing in digital libraries.

Table 5. Mean, standard deviation, and rank of using smart phones in organizing work category in descending order.

Statement number	Statement	Mean	Std. Deviation	Rank	Degree of use
12	I read and browse my course textbooks [in PDF or word formats] through my mobile.	2.42	0.760	High	1
9	I communicate with my classmates through the social networks by my smart phone.	2.41	0.776	High	2
10	I use my smart phone to follow up the university announcements.	2.28	0.840	Average	4
11	I organize and arrange for my lectures and tests by my smart phone.	2.22	0.841	Average	3
	Total	2.33	0.535	-	Average

Table 5 shows the degree of using smartphones by Bahrain college students according to the third section which is the Organization of the work. This table demonstrated that using smartphones in organizing the work has an average degree where was (2.33) and the standard deviation was (0.535). In addition, the survey questions that were under this section ranges between high degree and the average degree of using the smartphones in the process of organizing the work where the arithmetic mean range between (2.44 – 2.22). Furthermore, the first rank was the statement "I read and browse my course textbooks in PDF or word formats] through my mobile" with arithmetic mean that was (2.42) and a standard deviation that was (0.76). This statement showed that Bahrain college students have a high degree of using their smartphones in the process of reading and browsing the course textbook and diverse written materials.

The second rank was the statement "I communicate with my classmates through the social networks by my smartphone" with arithmetic mean that was (2.41) and a standard deviation that was (0.776). This statement showed that students in Bahrain colleges have a high degree of using their smartphones in the process of communicating with their classmates through a social network. The third rank was the statement which states "I use my smartphone to follow up the university announcements" with arithmetic mean that was (2.28) and a standard deviation that was (0.840). this statement showed that students in Bahrain colleges have an average degree of using their smartphones in the process of following the university announcement. The fourth rank was the statement which states "I organize and arrange for my lectures and tests by my smartphone" with arithmetic mean that was (2.22) and a standard deviation that was (0.8411). This statement showed that Bahrain college students have an average degree of using their smartphones in the process of organizing and arranging their lectures and tests.

Table 6. The mean, standard deviation, and rank of using smart phones in follow up and communication category in descending order.

Statement number	Statement	Mean	Std. Deviation	Rank	Degree of use
17	I use some smartphone applications to send questions or inquiries to my professors.	2.56	0.720	1	High
15	I communicate with my course professors through the smartphone.	2.55	0.712	2	High
16	I hold meetings with my classmates through using smartphone applications.	2.54	0.690	3	High
18	I use smartphone to finish my academic university tasks.	2.48	0.753	4	High
13	I use my smartphone to follow up my email communications.	2.36	0.786	5	High
14	I follow up urgent messages from the university by my smartphone.	2.34	0.819	6	High
19	I use the smartphone to do electronic presentations.	2.28	0.823	7	Average
	Total	2.44	0.520		High

Table 6 shows the degree of using the smartphone in the follow-up and communication category by Bahrain college students. It is high since the arithmetic mean was equal to (2.44) with a standard deviation (0.520). The statements below this category were ranging between high and average which could be represented by the arithmetic mean that was ranging between (2.45-2.28). The first rank statement that was statement states "I use a smartphone to finish my academic university duties" which got arithmetic mean equal to (2.56) and a standard

deviation that was (0.720). This statement showed that Bahrain college students have a high degree of using smartphones. The statement which was states "I communicate with my course professors through the smartphone" got arithmetic mean equal to (2.55) and a standard deviation that was (0.712). This statement is showed Bahrain college students have a high degree of using smartphones to communicate with the course professor. The last rank statement stated, "I use the smartphone to do electronic presentations" with an arithmetic mean that was (2.28) and a standard deviation equal to (0.823). This statement showed that students in Bahrain colleges have an average degree of using smartphones.

Table 7. Number of responses, mean of all categories, sum of the arithmetic mean, standard deviation of each category, and the sum of standard deviation of total of each category.

Statement	Mean	Std. Deviation	Degree of use
Total presentation of information	2.30	0.575	Average
Total browsing & searching	2.46	0.546	High
Total organizing work	2.33	0.535	Average
Total follow up and communication	2.44	0.520	High
The average	2.38	0.457	High

Table 7 shows the arithmetic mean and standard deviation of each category regard using the smartphone in the learning process. According to the total presentation of the information category with arithmetic, the mean is equal to 2.3, and a standard deviation is 0.575. The total arithmetic means of using a smartphone in browsing and searching for the information category is 2.46 and the standard deviation is 0.546. The total arithmetic means of using a smartphone in organizing the work category is 2.33 and the standard deviation is 0.535. The total mean of using a smartphone in a follow-up and communication category is 2.44 and the standard deviation is 0.520. The average sum of each category the arithmetic mean is 2.38 and the average standard deviation is 0.457.

Exploratory Approach

Principal axis factoring with oblique rotation was used to examine the validity of the smartphone items used at the college level in Bahrain. The suitability of the data was examined for exploratory factor analysis (EFA) with the Kaiser-Myer-Olkin (KMO) measure of sampling adequacy and the Bartlett test of sphericity. As suggested by Tabachnick and Fidell (2019), criteria for suitability are KMO > 0.8 and a p-value for Bartlett's χ^2 of less than 0.01. Three techniques were used to assist in deciding the number of factors to be retained:

(1) Kaiser's (1974) criterion to retain eigenvalues greater than 1.
(2) Catell's (1966) scree test.
(3) Horn's (1965) parallel analysis.

Although the Kaiser's criterion and the scree test are well known, parallel analysis is not as widely known but according to Hayton, Allen & Scarpello (2004), it is the most accurate criterion to use in the assessment of the number of factors to retain, given that both Kaiser's criterion and Catell's scree test tend to overestimate the number of factors. Using Kaiser's criterion, only factors with an eigenvalue greater than or equal to 1 are retained. The Catell's (1966) scree, however, involves plotting each of the eigenvalues of the factors and checking the plot. The factors above the point where the shape of the curve changes and become horizontal are retained for further analysis (Pallant, 2013).

Parallel analysis, developed by Watkins (2000) is a Monte Carlo simulation technique that assists researchers in deciding the number of factors to retain in Exploratory Factor Analysis (Ledesma & Valero-mora, 2007). Principal axis factoring revealed the presence of seven components with eigenvalues exceeding 1, accounting for a total of 59.48% of the variance. From the results of Catell's scree test and parallel analysis, four components were kept for further analysis. The results showed only four components with eigenvalues exceeding the corresponding criterion values for a randomly generated data matrix of the same size (19 items × 203 respondents).

Confirmatory Approach

The factor structure of the smartphone was examined by confirmatory factor analysis (CFA) using AMOS 27. The model fit was evaluated by Chi-square statistics and fit indices including the Comparative Fit Index (CFI: Bentler, 1990), Tucker-Lewis Index (TLI: Bentler & Bonett, 1980). For both CFI and TLI, a value greater than 0.90 indicates an acceptable fit to the data. A value greater than or equal to 0.95 indicates a good fit (Hu & Bentler, 1999).

The values of RMSEA of 0.05 or less indicate close fit, less than 0.08 indicate a reasonable fit, less than 0.10 indicate a mediocre fit, and greater than 0.10 indicate an unacceptable fit (Brown & Cudeck, 1993). A value of SRMR less than 0.05 indicates a well-fitting model (Byrne, 2010). One of the most common fit indices is Chi-squared statistics (χ^2). As suggested by Hu and Bentler, 1999, χ^2 is strongly dependent on sample size, and so, χ^2/df ratios are presented for each model. As recommended by Byrne (2010), χ^2/df ratios ranging from 2 to 5 are adequate to model fit. Chi-squared change ($\Delta\chi^2$) statistics (Hu & Bentler, 1999) was used to test for differences in fit between the 1-factor and 4-factor models.

FINDINGS

The inter-item correlations between the smartphone items were adequate for factor analysis (KMO = 0.84; Bartlett's χ^2 = 1688.71, $p < 0.001$). Item and factor analyses were conducted to identify those items whose removal would improve the internal consistency reliability and factorial validity of the smartphone scales. Principal axis factoring with oblique rotation was used because one can assume that the scales of the smartphone are somewhat related (Coakes & Ong, 2010). In Table 8, factor analysis reports the structure for the smartphone comprising 19 items in 4 factors and the factor loadings for the sample of 203 students for the smartphone questionnaire. All the 19 items of the smartphone had a loading of at least 0.40 on their a priori scale and no other scale. The percentage of variance for different factors ranged between 6.06% and 36.91%, with the total percentage of variance accounted for by the 19 items being 58.90%.

The largest contribution to variance was for the Factor 1 scale (36.91%). The eigenvalues for different smartphone scales ranged from 1.15 to 7.01. The results for the factor analysis with oblique rotation, reported in Table 3, strongly support the factorial validity of the 19-item, 4-scale, smartphone questionnaire when used in university classes in the Kingdom of Bahrain.

Table 8. Factor loadings, percentage of variance and eigenvalues for the smart phone items

Items	Factor 1	Factor 2	Factor 3	Factor 4
PI1	0.70			
PI2	0.75			
PI3	0.71			
PI4	0.83			
BSI1		0.72		
BSI2		0.70		
BSI3		0.79		
BSI4		0.89		
OW1			0.59	
OW2			0.88	
OW3			0.79	
OW4			0.58	
FC1				0.73
FC2				0.82
FC3				0.83
FC4				0.61
FC5				0.76
FC6				0.59
FC7				0.58
Eigenvalue	7.01	1.72	1.31	1.15
% variance	36.91	9.03	6.90	6.06

Convergent Validity

The convergent validity of the 19 items of the smartphone questionnaire was examined. The results (Table 9) indicate that all the factor loadings of the 19-item smartphone constructs met the minimum requirement of 0.5 suggested by Hair et al. (2010), ranging from 0.58 to 0.89. The composite reliability of each construct indicated that all the four factors exceeded the minimum reliability value of 0.7 as suggested by Fornell and Larcker (1981), ranging from 0.81 to 0.88 (see, Table 9). The average variance extracted (AVE) was more than 0.5, ranging from 0.50 – 0.61 (Hair et al., 1992; Nunnally & Bernstein, 1994).

Table 9. Composite reliability and average variance extracted and inter-correlations of the constructs

Construct	C.R	AVE	Factor 1	Factor 2	Factor 3	Factor 4
PI (Factor 1)	0.84	0.56	**(0.75)**			
BSI (Factor 2)	0.86	0.61	0.60**	**(0.78)**		
OW (Factor 3)	0.81	0.52	0.60**	0.55**	**(0.72)**	
FC (Factor 4)	0.88	0.50	0.64**	0.69**	0.61**	**(0.71)**

**p < 0.01
AVE = Average variance extracted; C.R. = Composite reliability
The bold elements in the main diagonal are the square roots of AVE and the off-diagonal elements are the shared variance.

Discriminant Validity
Discriminant validity was assessed by comparing the square root of the average variance extracted for a given construct and all the other constructs. The discriminant validity was achieved, based on the results in Table 9, where all the AVEs were greater than the inter-construct correlation (Barclay et al., 1995).

Confirmatory factor analysis
Confirmatory factor analysis (CFA) was used to examine two 20-item smart mobile models using AMOS 27, with maximum likelihood procedure as the technique for parameter estimation. The first model tested a four-factor. The second model tested a one-factor model. The fit indices for the four-factor model and the one-factor model are given in Table 10. As reported in Table 10, The 4-factor model obtained an acceptable fit to the data (χ^2 = 200.51, CFI = 0.95, TLI = 0.93, RMSEA = 0.05, SRMR = 0.05). Also, the 1–factor model obtained an unacceptable fit to the data (χ^2 = 266.35, CFI = 0.91, TLI = 0.89, RMSEA = 0.08, SRMR = 0.06). According to Chi-squared change ($\Delta\chi^2$) test, the 4-factor model indicated a statistically better fit than the 1-factor model ($\Delta\chi^2$ = 65.84, df = 8, p < 0.001). Therefore, the four-factor model appears to be a relatively good approximation of the data.

Table 10: Fit indices of the 1-factor and 4-factor models

Fit index	Level of acceptable fit	1-factor model	4-factor model
χ^2	n.s at p > 0 .05	266.35, p < 0.05	200.51, p < 0.05
df		130	122
χ^2/df	< 5	2.05	1.64
CFI	> 0.9	0.91	0.95
TLI	> 0.9	0.89	0.93
RMSEA	< 0.06	0.08	0.05
SRMR	< 0.05	0.06	0.05

Discussion
This study aimed to assess the psychometric properties of smartphones. The reliability and validity of a smartphone questionnaire were assessed. Exploratory factor analysis and internal consistency reliability was used to determine convergent and discriminant validity.

It was determined that the square root of the average variance extracted (AVE) was greater than the inter-construct correlation. Hence, convergent and discriminant validity of the items in the smartphone questionnaire was established. In this study, the results of CFA supported a four-factor solution. This study is significant because it is one of the few studies that has explored the factor structure and psychometric properties of a questionnaire that assesses students' perception of the use of smartphones in learning on an Arab college sample.

Conclusion
The present study has shown that the smartphone questionnaire can be used to determine students' perceptions of using smartphones in learning with high reliability and validity. This study contributes to the existing literature on self-report questionnaires to check students' perceptions of using smartphones in learning.

Recommendations
This study involved only one university in Bahrain. So, future studies can include students from other universities and colleges in Bahrain. Since the study took account of only students, future studies should include professors and instructors to have their perspectives on incorporating smartphones in teaching.

Limitations

This study has some limitations. A relatively small number of students and classes were involved in this study, so the results should not be generalized to other populations in Bahrain. Despite this limitation, a translated smartphone questionnaire has been made available for researchers and educators in Arabic-speaking countries.

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Responsive Classroom Curriculum and its Impact on Student Behavior

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ABSTRACT
The objective of this research was to observe any correlation between the implementation of social-emotional learning in the classroom and the social behaviors exhibited by students. Social-emotional programs, such as Responsive Classroom, have been observed to demonstrate positive effects on students' academic, behavioral, and social-emotional outcomes, as well as on the classroom climate. The relationships between social-emotional learning and student behaviors inside of the classroom was examined. This study shows positive impact related to utilizing the Responsive Classroom elements such as Closing Circle and Morning Meeting on students, teachers, and the classroom environment. This reflective and responsive time of the school day is a sacred time for students and teachers to connect, learn, and grow together.

INTRODUCTION
In schools today, teachers are required to meet the academic as well as the social-emotional needs of students. There is extensive research on this topic and how it is affecting overall school climate. Schools play a significant role in meeting students' social-emotional needs, as well as in their educational outcomes (Jayman, 2017). Our roles, as teachers, have changed. The classroom is focused on instructing students in standards-based educational content, in addition to group etiquette and social interaction skills. This is preparing them to enter the world outside of the classroom setting. While focusing on academics is certainly of importance, addressing social-emotional needs will empower students to be more successful in the job market and in their everyday lives.

Gregory and Fergus (2017) found that implementing social emotional lessons into the daily schedule created a healthier school environment and saw a decrease in disciplinary issues. Poulou (2017) found that the teacher-student relationship in the classroom is essential in academic success. When teachers engage in daily social-emotional lessons, they are encouraging positive social interactions between peers and adults. When respectful behavior is set as an expectation in the classroom, instead of only being integrated periodically throughout the year, students can focus on academics rather than social interactions. If students are required and encouraged to participate in daily social-emotional lessons, they form healthier relationships with both their teachers and peers. When the classroom climate is free of conflict, the students present less emotional and behavioral difficulties (Responsive Classroom, 2017).

Patterns in research on social-emotional learning (SEL) suggest that federal, state, and local policies should encourage all schools to focus on both students' academic and social-emotional development (Payton, et. al, 2008). Responsive Classroom is an effort that our school districts are doing to encourage consistent social emotional curriculum within the classroom setting.

> Responsive Classroom is an evidence-based education approach associated with greater teacher effectiveness, higher student achievement, and improved school climate. The approach was developed by a group of public elementary and middle school educators, who had a vision of bringing together social and academic learning throughout the school day. (Responsive Classroom, 2017, p.3)

Responsive Classroom practices four domains: Engaging Academics, Positive Community, Developmentally Responsive Teaching, and Effective Management. In addition, Responsive Classroom embraces a core belief as well as guiding principles. When guiding principles and the core belief are integrated together it is believed that the classroom and school will be more successful. Responsive Classrooms' Core Belief indicates that to be successful in and out of school, students need to be instructed in a set of social and emotional competencies, which include cooperation, assertiveness, responsibility, empathy, self-control, academic mindset, perseverance, learning strategies, and academic behaviors. Responsive Classroom's six Guiding Principles are as follows:

1. Teaching social and emotional skills is as important as teaching academic content.
2. How we teach is as important as what we teach.

3. Great cognitive growth occurs through social interaction.
4. How we work together as adults to create a safe, joyful, and inclusive school environment is as important as out individual contribution or competence.
5. What we know and believe about our students- individually, culturally, developmentally- informs our expectations, reactions, and attitudes about those students.
6. Partnering with families-knowing them and valuing their contributions- is as important as knowing the children we teach.

This is one approach to addressing the social deficit in today's classrooms. Teachers participate in professional development to learn how to implement Responsive Classroom within their own classrooms and are encouraged to have other teachers observe and offer suggestions (Responsive Classroom, 2017).

Social emotional lessons encourage students to become more aware of their emotions, give students strategies to manage conflict, and instruct them in how to collaborate with peers. While research has suggested the significant need for social emotional learning in the classroom, teachers have been encouraged to spend more time on core subject areas rather than focusing on SEL. If real changes are to be made, then it is essential that research is conducted to demonstrate the advantages of social-emotional lessons. This study hopes to discover how SEL lessons affect overall student behavior in the classroom and school. While also determining how SEL influences student relationships within the building.

According to Durlak, Weissberg, Dymnicki, Taylor, & Schellinger (2011), educators that embrace and promote social-emotional learning teach students that exhibit more positive attitudes, better overall behavior, and higher academic performance. SEL also develops school connectedness and overall engagement, both of which are important concepts for building relationships within a school (Usakli, & Ekici, 2018).

Despite the convincing body of research, schools lack a curriculum devoted to social-emotional education, and as a result, many students are at a disadvantage. When schools lack these programs, antisocial behavior often happens in the classroom. This can include poor academic performance, discipline issues, disaffection, lack of commitment, alienation, and an increased frequency of student dropouts. All these factors have the potential to limit success in school or even lead to a school's failure (Zins, Bloodworth, Weissberg, & Walberg, 2007).

Often, teachers feel like they have too many academic standards and simply do not have time to fit in another curriculum. However, Anderson (2015) explains, that educators should view a social curriculum as an integral part of their daily teaching instead of something else they need to fit in. Teaching students how to share, develop empathy for partners, excel in challenging situations, accomplish goals, and control impulsive behavior are just as important as academic skills (Anderson, 2015). Other educators claim that they do not know how to teach social-emotional skills. Anderson, 2015 states that social skills can be taught with the same structure that academic skills are taught. They should be modeled by the teacher, modeled by peers, coached in small groups or individually, practiced, and then potentially retaught before students acquire an understanding of the skill.

The primary focus of this study was to examine the influence of the Responsive Classroom Curriculum on student behavior at the upper elementary level. The upper elementary level is defined as third through fifth grade with student ages ranging from eight to eleven. "As classrooms become more diverse as a result of inclusion, the need to ensure that children develop pro-social and emotional skills and can create positive peer relationships in these settings becomes essential" (Sokal & Katz, 2017, p. 7). There has been a big push recently for schools to focus on the soft skills in combination with the core academic skills. The belief is that increased SEL awareness will increase positive classroom behaviors. "Current knowledge suggests that programs and approaches to enhance social and emotional growth hold promise for improving classroom social processes, peer interactions, and academic learning" (Rim-Kauffman & Chiu, 2007, p. 397). We want to focus specifically on implementing the Responsive Classroom Curriculum in schools that have students from diverse backgrounds including students that may have been affected by traumatic experiences as well as a population of "at risk" students. Slevin, Karweit & Madden (1989) define at risk students.

> One possible definition is that students who are at risk are those who, on the basis of several risk factors, are unlikely to graduate from high school. Among these risk factors would be low achievement, retention in grade, behavior problems, poor attendance, low socioeconomic status, and attendance at schools with large numbers of poor students. (p. 5)

As mentioned, an emphasis on SEL has heavily influenced the world of education in recent years. This study examined the true advantages that a social-emotional curriculum can have on the classroom and larger school environment. SEL programs, such as Responsive Classroom, have been observed to demonstrate positive effects

on students' academic, behavioral, and social-emotional outcomes, as well as on overall classroom climate (Responsive Classroom, 2015). For this reason, the primary stakeholders throughout this study are both students and teachers. As teachers' model and demonstrate these skills, students develop and fine tune their social-emotional competencies. Consequently, educators can cover more academic content while students are able to flourish in their given educational setting. This study will reveal the significant, educational assets that a social-emotional program like Responsive Classroom has on both students and teachers alike.

Throughout our research, we hoped to answer the following questions regarding SEL and the use of Responsive Classroom:

1. In what ways does Responsive Classroom affect student success in the classroom?
2. Which aspect of Responsive Classroom is viewed as most important by teachers?
3. Responsive Classroom stresses the importance of building relationships. Do stronger relationships between teachers and students as well as between peers help students gain higher self-efficacy?
4. How will students' behaviors be impacted by the Responsive Classroom Curriculum?

RELATED LITERATURE

Social-emotional lessons encourage students to become more aware of their emotions, give students strategies to manage conflict, and instruct them in how to collaborate with peers. While research has suggested the significant need for social-emotional learning in the classroom, teachers have been encouraged to spend more time on core subject areas instead of focusing on social-emotional learning (SEL). "Current knowledge suggests that programs and approaches to enhance social and emotional growth hold promise for improving classroom social processes, peer interactions, and academic learning" (Rim-Kauffman & Chiu, 2007, p. 397).

If changes are to be made, then it is essential that research is conducted to demonstrate the advantages of the use of social-emotional lessons by teachers in the classroom. This study hoped to discover how SEL lessons affect overall student behavior in the classroom and within the school and how SEL influences student relationships within the building.

SOCIAL-EMOTIONAL LEARNING

Education means more than proficiency in content. The true purpose and function of schools should extend far beyond a place where students come to learn core subjects such as math, reading, and writing. Successful schools balance teaching basic skills while scaffolding a social environment to effectively build 21st century communication skills. Similar to academic disciplines, social-emotional learning (SEL) is best explained as a process by which skills are acquired, developed, and applied. Furthermore, SEL includes emotion management, effective problem solving, and positive relationship maintenance--competencies that clearly are essential for all students. Overall, SEL provides students with the ability to understand and regulate their emotions while equipping them with the necessary skills to understand the emotions of others. There are five overarching skills that are related to SEL: Self-awareness, self-management, social awareness, relationship skills, and responsible decision-making (Schonert-Reichl, 2017). Usakli and Ekici (2018) state that social-emotional learning is essential regarding the success of students, teachers, and school environments.

Research has shown many benefits of SEL, such as improved student ability to recognize and manage emotions, deepened understanding of emotional perspectives of others, interpersonal situational management, as well as increased responsibility in decision-making. SEL also develops school connectedness and overall engagement, both of which are significant components when it comes to building relationships within a school (Usakli, & Ekici, 2018). Although academics are not specifically measured in this study, according to researchers Patricia Jennings at the University of Virginia and Mark Greenberg at Pennsylvania State University, the level of quality maintained in teacher-student relationships, classroom management, and SEL programs all heavily influence student outcomes on both academic and social levels (Schonert-Reichl, 2017). Therefore, if the abilities of teachers are optimized in the implementation of SEL lessons, students' social-emotional and academic competencies will build and grow from year to year.

THE HISTORY OF SOCIAL-EMOTIONAL LEARNING

Social-emotional learning has had a timeless and enduring history that has withstood centuries worth of educational ideologies. The true origins of SEL date back to ancient Greece and Plato's reflections of education. Through his writings, he suggested a comprehensive curriculum that requires a balance of physical education, the arts, math, science, as well as character and moral judgement ("Social and emotional," 2011). Plato writes, "By maintaining a sound system of education and upbringing, you produce citizens of good character" ("Social and emotional," 2011). In more recent years, James Comer--a significant professor at the Yale Child Study Center and prominent voice in the field of education-- began a program called the Comer School Development Program. The program, launched in the 1960s, focused on the idea that "...the contrast between a child's experiences at home and those in

school deeply affects the child's psychosocial development and that this in turn shapes academic achievement" ("Social and emotional," 2011). The Comer School Development Program chose two poor, low-achieving elementary schools in New Haven, Connecticut. With the help of the program, the school updated both academic and social policies that previously had adverse effects on the students in attendance. As a result, the academic performance of the two schools exceeded the national average and behavior problems had declined by the 1980s. James Comer's success drew attention to the SEL movement, encouraging a multitude of professional researchers to become involved. By the 1990's social-emotional learning has made its way as both a meaningful and significant approach to education. There is no denying the incessant need for teaching children how to be responsible, productive, caring, and engaged citizens ("Social and emotional," 2011). SEL has continued to support this pursuit throughout its long and lasting history.

SOCIAL-EMOTIONAL LEARNING AND ITS INFLUENCE ON EDUCATION

The influential role that social-emotional learning plays on education is undeniable. Without an emphasis on SEL, students lack a sense of unity among peers as well as the learning community, and struggle more with overall academic content. When schools lack these programs, students are often at a disadvantage and may exhibit a number of negative behaviors. These behaviors include poor academic performance, discipline issues, disaffection, lack of commitment, alienation, and an increased frequency of student dropouts. As a result, these consequences have the potential to limit success in school or even lead to a school's failure (Zins, Bloodworth, Weissberg, & Walberg, 2007). SEL is crucial to students, teachers, and schools in creating a safe environment as they work to build social skills, connect with peers through academic content, and to make connections with staff throughout the building. It is clear that a social-emotional curriculum influences the lives of those invested in education--but in what ways? Social-emotional learning is responsible for affecting behavior, relationships, as well as overall learning.

SOCIAL-EMOTIONAL LEARNING AND HOW IT AFFECTS BEHAVIOR

According to Schonert-Reichl (2017), a recent report from the National Council on Teacher Quality found that there is relatively little attention paid to classroom management in pre-service teacher education. Today's teachers do not feel equipped to deal with the behaviors they are facing within their classrooms every day. Teachers who lack skillful classroom management allow the behaviors of students to take over the academic learning and daily routines. Gregory and Fergus (2017) found that implementing social-emotional lessons into the daily schedule created a healthier school environment and enhanced educators' overall abilities to teach students social-emotional competencies. Equally important, the researchers also saw a decrease in negative student behaviors and discipline issues overall. With the implementation of a social-emotional curriculum, teachers will spend less time focusing on student behavior and more time on academics.

Many schools have found that implementing this multi-tiered system of support has led to a decrease in students being disciplined outside of the classroom through the use of in-school (ISS) or out-of-school (OSS) suspensions. Therefore, these students are not missing academic lessons (Gregory & Fergus, 2017). Instead of focusing on punishment for behavior, implementing SEL throughout schools has the potential to change the code of conduct within the building. Schonert-Reichl (2017) confirms that social and emotional skills can "be taught and measured [and] can promote positive development and reduce problem behaviors within the school setting"(p.138). Incorporating SEL within a classroom setting would create a healthier social-emotional environment, in addition to strengthening educators' own social and emotional competencies. Consequently, this leads to improved teacher abilities when it comes to instructing students (Gregory and Fergus, 2017).

SOCIAL-EMOTIONAL LEARNING AND HOW IT AFFECTS RELATIONSHIPS

Educators are encouraged to support students' social-emotional development, with the full knowledge that this support will result in non-academic outcomes, particularly in the areas of relationship building and psychological health (Konishi & Park, 2017). Most researchers agree that this human side of learning, which includes problem-solving, communication, and self-knowledge, are of equal importance to the development of academic knowledge (Hoffman, 2017). However, despite this consensus, social emotional learning often takes a backseat to core subject material--the three Rs of reading, writing, and arithmetic--due to the pressures of standardized testing requirements (Konishi & Park, 2017). According to Poulou (2015), multiple studies have demonstrated that the role of the relationship between teachers and students is a strong predictor of student behavior. It is empathy, trust, and acceptance in these relationships that are the major contributors to students' emotional growth and development (Colley & Cooper, 2017).

Social learning theory suggests that the introduction and practice of social interactions influence the development of new behaviors. Ideally, this school-provided programming would translate to student home lives, as well (Domitrovich, Durlak, & Weissberg, 2017). In their research, Konishi and Park (2017) suggest that students who

engage in social-emotional learning also exhibit good mental health in comparison to their peers who do not. Those students who do not have the same social emotional learning experiences tend to have poorer mental health, which may include anxiety or depression, and often have destructive relationships with peers and other people in their lives. Colley and Cooper (2017) point out that "all learning is emotion-based" and high-quality academic learning can only truly take place when social emotional abilities are adequately supported and taught (p. 12).

In her book, *Everyday SEL in Middle School*, Carla Philibert (2016) notes that an SEL equivalent to a standardized test exists in the form of students' everyday abilities to deal with stress and emotionally fired situations. Given that students frequently face these types of instances, it is pertinent that they are taught the necessary skills of communication and empathy. The essential nature of school-based academic learning is relational, meaning social emotional learning is required for students to both build and maintain relationships (Hoffman, 2017). Throughout their lives, students' management of their relationships with others will be crucial. Students without the abilities to effectively "negotiate conflict and resist pressure" will struggle to make their way in a world that deals in those skills (Colley & Cooper, 2017, p. 26). Engagement and self-esteem are the two most vital components of keeping students interested in their schooling. Both factors are inextricably linked to teacher-student and peer relationships, which rely upon social-emotional competencies (Hoffman, 2017).

SOCIAL-EMOTIONAL LEARNING AND HOW IT AFFECTS LEARNING

Twenty-first century schools instruct diverse students with a variety of strengths, interests, and motivations for learning. While some students participate daily and enjoy coming to school, others are less engaged and less motivated. Preparing students for their future requires an education that not only teaches academics but prepares them to collaborate, problem-solve and cooperate with those around them (Payton et al., 2008). Social emotional learning provides those skills and opportunities for students.

In a 2011 analysis of 213 studies that collectively included over 270,000 students, results indicated that participants who took part in SEL programming through their schools demonstrated higher academic gains than those who were not enrolled in similar programs (Collaborative for Academic, Social, and Emotional Learning, 2018). This analysis further demonstrates why social emotional learning is imperative for student success. Even considering this well-researched fact, SEL continues to be overlooked in the day-to-day school curriculum. SEL provides students with the necessary tools to interact with the world around them, including communication with themselves, their peers, teachers, and other adults. SEL also provides students with a sense of empathy while developing their sense of humanity. According to Jones and Kahn (2018), students who experience SEL in school are better able to work constructively and collaboratively with classmates, build a sense of perseverance, have a sense of overall purpose, and are much more likely to "maximize their opportunities and reach their full potential" (p. 16).

A RESPONSIVE CLASSROOM APPROACH

According to Baroody, Rimm-Kaufman, Larsen, & Curby (2014) Responsive Classroom is a social emotional learning intervention with an additional focus on the delivery of content. It was developed by the Northeast Foundation for Children (NEFC) with the idea that proper social-emotional learning will benefit a student academically and increase their overall well-being. There have also been studies to suggest increase in motivation and self-efficacy for teachers. Responsive Classroom is built on six guiding principles as well as specific strategies and competencies to help create a classroom environment that is conducive to learning. The principles stress the importance of social interactions, understanding bias, and the idea of promoting a community of learners even extending to their families. The practices are built upon the same ideals of creating a safe space for children to learn and explore. Some examples of these practices include Morning Meetings, setting rules and goals, brain breaks, modeling, logical consequences, and reflection.

The basis for this approach requires teachers to understand their students and respective families on a more personal level with a focus on building rapport and relationships (Arby, Rimm-Kauffman, Hulleman, & Thomas, 2012). This is the purpose behind some of the practices put in place with this particular SEL program. They continue to recognize that relationships remain important, yet the benefits and outcomes seem to change over the course of a child's educational career, starting from increased academic growth to motivation and achievement gains. The hope is that through these practices teachers would be able to create an environment free of behavior issues, while providing opportunities to interact with others and allow for academic choice.

The Responsive Classroom Approach can be used in multiple classroom settings with remarkably diverse students. Bruce, Fasy, Gulick, Jones, & Pike (2006) describe the benefits of Responsive Classroom approach in both special and general education classes, noting the academic benefits as well increased communication skills specifically of

Morning Meetings. Morning Meetings are one of the key Responsive Classroom practices at the elementary level and are intended to promote socialization skills as well as establishing a community within the classroom.

Responsive Classroom recommends that during the first week of the school year students should begin to articulate academic and social learning goals, or what others may call *hopes and dreams*, for the school year. These should be goals that students can work on throughout the year. This goal setting sets a tone for students for the rest of the school year (The First Six Weeks of School, 2015). They are then responsible for their goals and holding their peers accountable. Considering that these goals are both social and academic, these goals will set the foundation for what students are learning throughout the school year.

Responsive Classroom provides educators with resources and strategies for establishing rules, interactive modeling, teacher language, responding to misbehavior, engaging academics, academic choice, and implementing subjects into Morning Meeting (Responsive Classroom Course for Elementary Educators, 2017). When students can use their strengths and interests to make a desired choice, their academic achievement increases.

Although the SEL movement has gained extensive recognition and took off in the 1990's, some of the major gaps in research include: an overwhelming variety of curriculums, teacher choice, and the interpretation of SEL. As mentioned, social-emotional learning involves a variety of programs and curriculums to enhance classroom climate and learning. Therefore, it can be difficult for research to provide generalizations for the entirety of the field (Hoffman, 2009). Different programs include different requirements. There are in school lesson-based curricula, in school non-lesson-based curricula, and out of school programs. As a result, these programs have conflicting requirements and varied practices. For example, some programs suggest different times each week to spend on skills, other programs work on or provide different skills to practice, while many programs offer a contrasting way to practice these skills in the classroom.

A second gap are the explicit circumstances throughout each classroom regarding SEL. All teachers set up their classrooms differently and will interpret the curriculum in diverse ways. Therefore, it can be extremely difficult to determine consistency between teachers and classrooms (Hoffman, 2009). Teachers also have control of when, where, and how often they incorporate SEL into the curriculum. Some educators see SEL as another burden to fit into their standard curriculum.

Finally, there is much confusion and concern over the definition of the term social-emotional learning. Each study has a different term for what SEL means and what it looks like in the classroom. Another way individuals can interpret SEL differently is through diverse cultures. Talking and reviewing emotions openly is a cultural preference of American White middle-class. It is also the norm to work towards preserving students' ability to express their emotions freely (Hoffman, 2009). Students from other cultures may be taught to manage their emotions very differently than a specific SEL curriculum (Hoffman, 2009).

METHODOLOGY

A qualitative approach was used to measure the effects of social-emotional learning in the classroom. Participating teachers collected qualitative data that pertains to the principles of Responsive Classroom. Four classrooms at four school districts in central Illinois were part of this study in which the researchers implemented different components of Responsive Classroom at different times.

Prior to the start of research, participating teachers filled out rubrics for each student. Data was gathered again at the midpoint of the study and at the conclusion of the research to see the effects Responsive Classroom may have on social-emotional behaviors. This rubric was intended to examine students' social-emotional behaviors within the classroom and throughout the school. The rubric consisted of social-emotional behaviors related to the research questions of this study paired with grade-level specific standards from the Illinois State Board of Education.

Participating teachers kept observation logs throughout the duration of the study. The observation logs included records of specific behaviors seen in the school setting. Participating teachers kept reflective journals throughout the study that was used for Responsive Classroom component launch dates, details that pertain to the different components of the lessons, and considerations for moving forward with social-emotional lessons specific for their classroom. At the completion of the study, the participating teachers exclusively completed a survey that was intended to help identify the effects these Responsive Classroom components have on social interactions, academics, behavior, and overall success. Participating teachers assigned a numerical value of 0-5 for every student and each corresponding behavior. A score of 0 indicated that the student never demonstrated the listed behavior, while a score of 5 indicated that the student regularly demonstrated the listed behavior.

Participating teachers completed a survey at the end of the study. The survey used a five-point Likert scale to examine the degree social-emotional lessons were beneficial in their classrooms, the ways in which social-emotional lessons affected students, in addition to the overall quality of specific components of Responsive Classroom. The survey included a comment section that allowed the researchers to look for trends in their responses.

After the completion of the rubrics, the researchers analyzed and summarized the data by graphing the initial, midpoint, and end of study rubric scores. This data was organized into a bar graph displaying the ways in which Responsive Classroom principles have had an impact on the social-emotional behaviors indicated by the rubric.

Once the surveys have been administered to the teachers participating in the study, the data was summarized by analyzing the amount of time that teachers spent teaching social-emotional lessons vs. academic content, while also examining the success of student behavior and relationships inside the classroom setting. Finally, the teacher surveys were studied for common trends and themes.

The research was set-up to include a diverse population sample. All four participating schools have a wide range of differences including the numbers, age, and gender of students in attendance, the racial makeup of students, as well as the socio-economic status of the surrounding communities. A diverse group of participants allows for more realistic and valid results. The research also examined multiple data points across a span of roughly 5 months to identify successes of Responsive Classroom. The participating teachers also have more than four years of teaching experience and have been able to use the first half of the school year to identify specific behaviors to target when implementing Responsive Classroom. This allowed for more reliable feedback in the teacher's journal and observation logs for the classroom.

The following questions regarding social-emotional learning and the use of *Responsive Classroom* was investigated throughout the research:

1. In what ways does *Responsive Classroom* affect student success in the classroom?
2. Which aspect of *Responsive Classroom* is viewed as most important by teachers?
3. *Responsive Classroom* stresses the importance of building relationships. Do stronger relationships between teachers and students as well as between peers help students gain higher academic achievement and/or higher self-efficacy?
4. How will students' behaviors be impacted by the *Responsive Classroom* Approach?

DEFINITION OF TERMS

The following terms were used in the study:

- Responsive Classroom -- an evidence-based approach to teaching that focuses on engaging academics, positive community, effective management, and developmental awareness
- Social-emotional learning -- a wide range of skills, attitudes, and behaviors that can affect a student's overall success in school
- Socio-economic status -- the social standing or class of an individual or group

This research was intended to be as sound as possible. However, gaps in data may exist largely because each participating teacher began at a different point with Responsive Classroom. While some teachers had never implemented any of the Responsive Classroom principles, other classrooms have them embedded within their daily routines. Each classroom and school were diverse and what works in one classroom may not work in another. This study was be limited in that results may be unique to the schools in the study and may not apply to all schools in general. One semester of collecting data on social-emotional learning lessons might not be enough to show definitive results in terms of the effect of the lessons. The high population of students being pulled out of the classroom or high mobility within the district may skew the data. The study was reliant on educators to include the social-emotional learning curriculum in the classrooms. Depending on other requirements placed on the teachers, school functions, and other daily tasks, this may prove difficult to consistently follow through with. Although some scores may show significant growth for students throughout the study, the growth may not be an effect of using Responsive Classroom in the curriculum.

DATA ANALYSIS AND INTERPRETATION

The objective of this research was to examine the correlation between the implementation of social-emotional learning in the classroom and the social behaviors exhibited by students. Researchers examined students from four different schools of many sizes, in three different towns located in Illinois. The relationships between social-emotional learning and student behaviors inside the participating classrooms were also examined. More specifically, the following questions regarding SEL and Responsive Classroom were investigated:

1. In what ways does Responsive Classroom affect student success in the classroom?
2. Which aspect of Responsive Classroom is viewed as most important by teachers?
3. Responsive Classroom stresses the importance of building relationships. Do stronger relationships between teachers and students as well as between peers help students gain higher self-efficacy?
4. How will students' behaviors be impacted by the Responsive Classroom Curriculum?

Throughout the research, participating teachers completed rubrics on their students without personal identifiers created to assess the Illinois Social-Emotional standards. The rubrics assessed the following social-emotional standards: 1A Identify and manage one's emotions and behavior. 1B Recognize personal qualities and external supports. 1C Demonstrate skills related to achieving personal and academic goals 2A Recognize the feelings and perspectives of others. 2B Recognize individual and group similarities and differences. 2C Use communication and social skills to interact effectively with others. 2D Demonstrate an ability to prevent, manage, and resolve interpersonal conflicts in constructive ways 3A Consider ethical, safety, and societal factors in making decisions. 3B Apply decision-making skills to deal responsibly with daily academic and social situations 3C Contribute to the well-being of one's school and community. The graph is compiled of averaged data from all four classrooms by each individual standard.

After completing the rubrics, researchers analyzed and summarized the data by graphing the initial, midpoint, and end of study rubric scores. This data was organized into a bar graph illustrating the ways in which Responsive Classroom principles have had an impact on the social-emotional behaviors indicated by the rubric. At the end of the survey, participating teachers were also given a survey to determine the effectiveness of Responsive Classroom. Once the educator survey was administered, the data was summarized into pie graphs showing the amount of time that teachers spent teaching social-emotional lessons vs. academic content, while also examining the success of student behavior and relationships across the classroom setting. Finally, the teacher surveys were studied for common trends and themes. The following themes emerged from the data:

THEME 1: BUILDING COMMUNITY

The first major theme that emerged from the data was that Responsive Classroom elements such as Morning Meetings and Closing Circles, positively affect building a classroom community. This finding specifically connects to the research question, do stronger relationships between teachers and students as well as between peers help students gain higher self-efficacy? The research data from fig. 1 shows the positive impact Closing Circles and Morning Meetings have on students. Recognizing the feelings and perspectives of others, demonstrating an ability to prevent, manage, and resolve interpersonal conflicts in constructive ways are both areas that students grew. Considering the ethical, safety, and societal factors in making decisions, applying decision-making skills to deal responsibly with daily academic and social situations, and contributing to the well-being of one's school and community.

In analyzing researchers' field notes, they provide insight into the growth of students throughout the study. One researcher shared in their field notes that, "Students understand that closing circle is a time when we can reflect on our day, say goodbye to classmates, and learn from one another - building community." Schonert-Reichl (2017) confirms that social and emotional skills can "be taught and measured [and] can promote positive development and reduce problem behaviors within the school setting"(p.138). Researchers also shared the positive impact of Closing Circles on their end of the day routine and students' behavior during pack up. An example of one researcher's field notes stated, "Closing Circles help end the day on a positive note no matter how the day started or how the day went." Another researcher described, "Students are starting to help each other become more self-aware. Reminding each other of their goals, choosing partners that will improve them. They are relying on their classroom family for support."

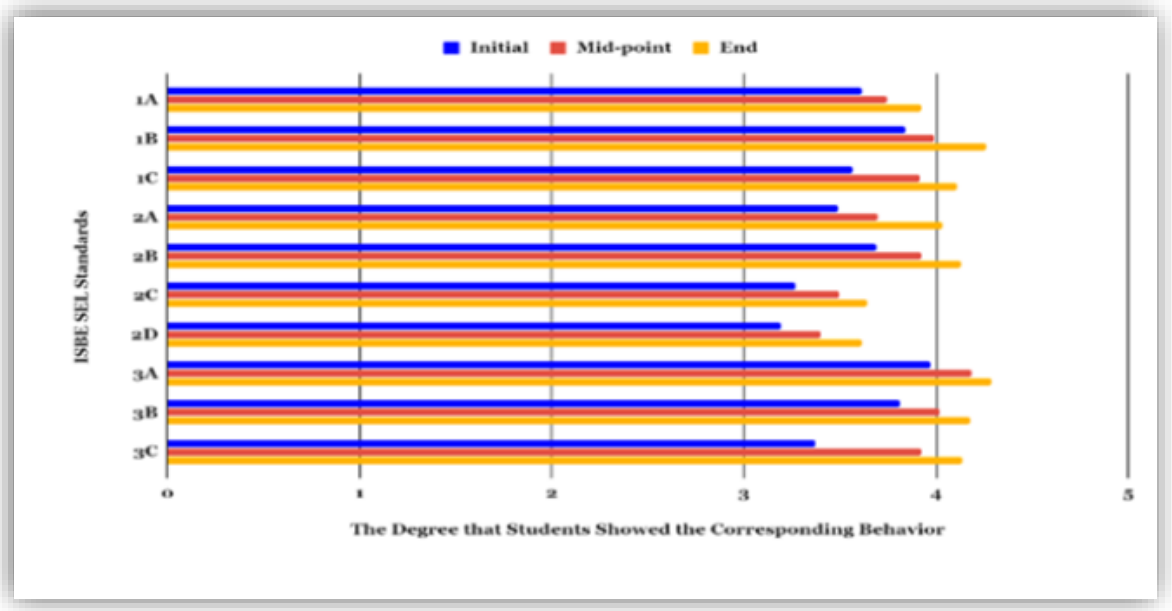

Figure 1. Effectiveness of Responsive Classroom.
Note. The figure shows the average of how teachers rated their students on each ESL standard from the beginning of the study to the end. The degree is determined with 5 representing the most and 1 being the least.

According to Jones and Kahn (2018), students who experience SEL in school are better able to work constructively and collaboratively with classmates, build a sense of perseverance [and] have a sense of overall purpose…" (p. 16). These skills all promote a positive classroom community.

Closing Circle and Morning Meetings not only help build classroom community between peers in the classroom but also help establish student to teacher relationships as well. Incorporating social-emotional lessons within a classroom setting creates a healthier social-emotional environment, in addition to strengthening educators' own social and emotional competencies. Consequently, this leads to improved teacher abilities when it comes to instructing students (Gregory and Fergus, 2017). A researcher explained, "I learned a lot about my students that I did not know before. Much of what students shared gave a clearer picture into potential socio-economic and traumatic issues. I was surprised at how much I learned about my students." Gregory and Fergus (2017) found that implementing social-emotional lessons into the daily schedule created a healthier school environment and enhanced educators' overall abilities to teach students social-emotional competencies. Instead of focusing on student behavior, implementing social-emotional lessons throughout schools has the potential to change the code of conduct across the building.

Figure 1 illustrates how standard 2D (Demonstrate an ability to prevent, manage, and resolve interpersonal conflicts in constructive ways) has drastically improved for participating students involved in this study. Students gained understanding and knowledge on how to respectfully problem solve through issues by identifying consequences of a solution and specific conflicts. In addition, reflecting on standard 3B (Apply decision-making skills to deal responsibly with daily academic and social situations), students showed growth by describing ways to promote the safety of themselves and others, while generating alternative solutions to problems. Figure 2 shows that 100% of the researchers believed that using Responsive Classroom elements improved the interactions between students and made them more respectful.

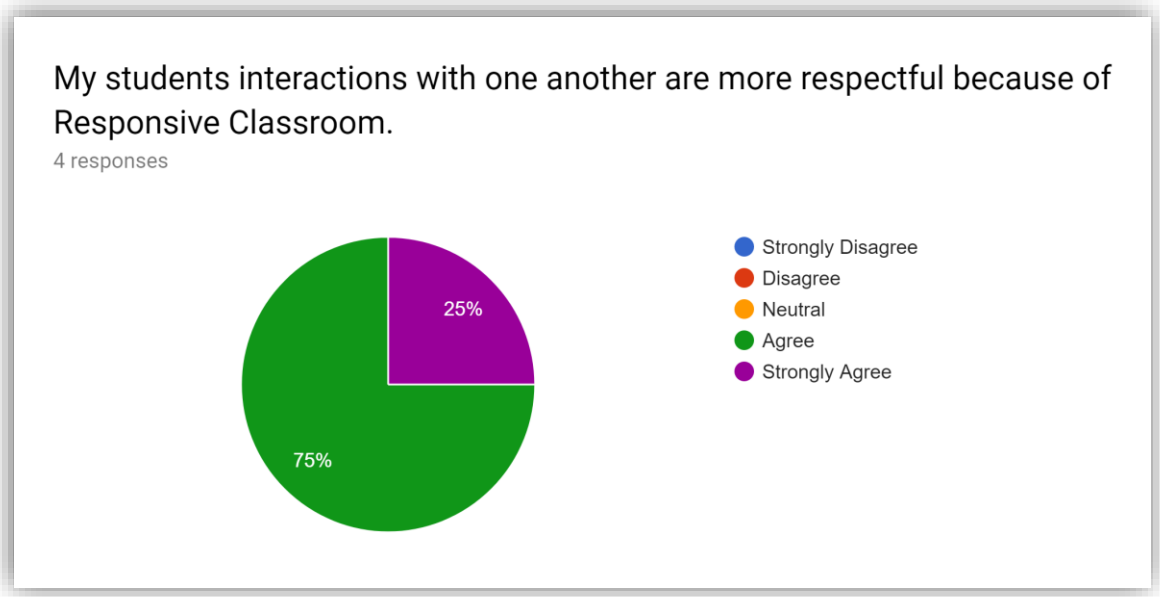

Figure 2. Improved student interactions due to Responsive Classroom.
Note: This figure shows the teacher researchers opinions of the impact Responsive Classroom had on student interactions

THEME 2: COMMUNITY SKILLS

Our research has identified a second common theme; we have found that the addition of Responsive Classroom's Morning Meeting or Closing Circle encouraged communication between student to student, staff to student and staff to staff. This key finding is connected to many of the research questions and provides a better understanding for the impact Responsive Classroom has on students and their social-emotional learning.

A research question we continued to refer to throughout the study was, in what ways does Responsive Classroom affect student success in the classroom? Student success in the classroom is impacted by the communication skills students possess. Mahmud (2014) states, "…oral communication proficiency contributes greatly to academic performance." Our study found that student communication skills increased through the addition of Responsive Classroom elements. One researcher described in their field notes that, without any facilitating from the teacher after the implementation of Closing Circle, two students explained to one another that their feelings were hurt due to the other student's actions. Through their conversation students were able to problem solve their issues appropriately and independently. Another researcher wrote, "[The students] understand how to communicate with one another during these meetings." Teacher field notes as well as researcher surveys also support the idea that communication skills have increased since the implementation of Closing Circle or Morning Meeting. As shown in figure 1 pictured above, our data projects a clear increase from the beginning to the end of the study regarding student communication skills addressed in ISBE standard 2C (Use communication and social skills to interact effectively with others). These findings show that the implementation of Responsive Classroom methods can lead to improved communication skills between students and staff.

Across all researchers' classrooms we have discovered that the addition of Morning Meeting or Closing Circle has helped provide opportunities for students to engage with one another in a safe, open space. Students use this time to practice and build their communication skills. One teacher recognized that when Morning Meeting was first implemented one student did not want to communicate with their peers. As the study continued, this child progressively improved his communication skills and participated in meeting time and in class time. Responsive Classroom elements allow for the opportunity to gain experience from one another, build relationships and connections with peers, share stories, and positively engage with students and staff alike.

These findings are supported in other research as well. The Responsive Classroom Website states, "Independent research has found that the Responsive Classroom approach is associated with higher academic achievement, improved teacher-student interactions, and higher quality instruction." The key findings of communication skills as a common theme across the four classrooms as well as the additional research provide significant support for the benefits that Responsive Classroom holds.

THEME 3: FOSTERING RELATIONSHIPS

The third overarching theme that was found through investigating and interpreting data, was that implementing Responsive Classroom fosters relationships inside the classroom setting. One of the questions that the study addressed were the ways in which Responsive Classroom affects student success in the classroom. Responsive Classroom encompasses social and academic skills into a learning environment that is responsive to all students' strengths and needs. Through the implementation of Morning Meeting and Closing Circle, students were able to develop relationships with their peers and teachers more frequently. For example, one participating researcher's field notes, in response to a prompt asking students what their favorite part of the day was, read as follows: "Hanging out with my friends and seeing my teacher."

The analysis and interpretation of field notes led the researchers to believe that fostering relationships led to academic success. One participating researcher's field notes, in response to a prompt asking students what made them laugh today, "The student related his laughter to our reading lesson on Hyperboles. After they shared, the class laughed with the student about that item." This observation note identifies that students are building relationships with one another and are comfortable to share with each other. These observations also show that students are connecting their feelings to their academic successes. Another participating researcher stated, "This was the first time where a student brought up how they helped someone else accomplish the closing circle topic. This shows that closing circle and Responsive Classroom practices help encourage positive relationships between peers."

THEME 4: GOAL SETTING

A fourth overarching theme that became discernible throughout the consideration and interpretation of related research data, was the notion that Responsive Classroom practices encourage goal setting. One question this study addressed was the ways in which student behaviors were impacted by a Responsive Classroom curriculum. Because much of what Responsive Classroom emphasizes focuses on the use of reflective skills, it came as no surprise that student behaviors were significantly impacted by participating more in the goal setting process. Through the implementation of Morning Meeting and Closing Circle, students were articulating academic and social-emotional goals more regularly. For example, one participating researcher's field notes, in response to a prompt asking students how they can show focus during the next school day, read as follows: "Student 2 responded that his wish was to become a better reader...and student 18 wished that everyone could practice great listening skills in order to really hear each other during closing circle."

A second question investigated throughout the course of this study, uncovered the degree to which Responsive Classroom affected student success in the classroom. The analysis of field notes led to the discovery of an undeniable pattern across the research. As students were setting more academic and social-emotional goals, they were doing so with their own strengths and areas of improvement in mind. Furthermore, students began to really tailor their specific goals to a more day by day and need by need basis. A participating researcher's observations and field notes, disclosed later in the study, explained that "...students were sharing more specific [goals]. One student did not just say I want to get better in math, that student said, 'I want to memorize all of my multiplication math facts.'" These observations illustrate clearly that students were beginning to develop better understandings about both their academic strengths as well as potential areas for improvement. A second participating researcher observed students choosing partners based on their strengths and weaknesses, or partners that will "...help push them." Because students now have a better understanding of their personal academic and social-emotional skills, they are better able to make deliberate decisions and seek out appropriate supports that will influence their overall accomplishments in the classroom. Student cognizance of academic and social-emotional strengths and weaknesses, paired with purposeful working partnerships, are both observed behaviors that demonstrate students' trajectory for success in the classroom.

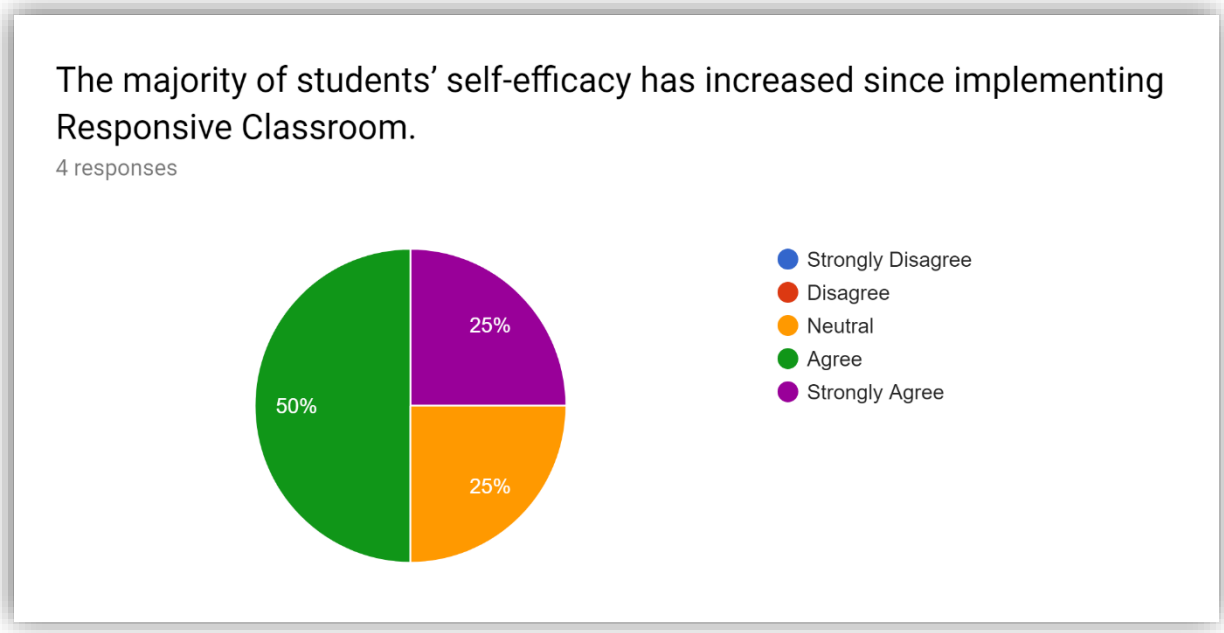

Figure 3. Improved student self-efficacy due to Responsive Classroom.
Note: This figure shows the teacher researchers opinions of the impact Responsive Classroom had on student self-efficacy

Figure 1 Clearly illustrates the key role of goal setting in education. From start to finish, student scores show that areas of the rubric that focused on goal setting behaviors, grew immensely. Social-emotional standards 1B (recognize personal qualities and external supports) and 1C (demonstrate skills related to achieving personal and academic goals), pictured on fig. 1, show consistent and steady growth when comparing scores from the initial, mid-point, and end of the study.

According to the teacher survey, given at the end of the data collection window, and the data shown on fig. 3, 75% of the participating educators found that Responsive Classroom significantly increased self-efficacy for most students in their classrooms.

The information and statistics listed above align with and confirm the previous findings examined in the literature piece of this study. Jones and Kahn (2018), referenced earlier, explained that students involved with SEL in school are better able to work constructively and collaboratively with classmates, build a sense of perseverance, have a sense of overall purpose, and are much more likely to "maximize their opportunities and reach their full potential"--all skills needed for goal setting in the classroom (p. 16). This study, heavily supported by previous studies, demonstrates that goal setting is an inherent part of any educational setting. For students to grow and thrive, they must possess an awareness of their strengths and embody the perseverance and drive to accomplish future goals. Social-emotional curriculums, like Responsive Classroom, teach and model these goal-setting behaviors. These elements better prepare students to engage with critical thinking and cope with potentially challenging circumstances both inside and outside of school walls. These skills will undoubtedly follow students as they work their way through our school system and beyond, as they face the everyday demands of life, employment, and adulthood.

In the end, our research shows the positive impact the Responsive Classroom elements such as Closing Circle and Morning Meeting can have on students, teachers, and the classroom environment. This reflective and responsive time of the school day is a sacred time for students and teachers to connect, learn, and grow together.

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APPENDIX A

Rubric

Directions: Fill out one rubric per child. There should be no personal identifiers included and all rubrics should be anonymous.

ISBE SEL Standard	0	1	2
1A Identify and manage one's emotions and behavior.	Student cannot show a variety of emotions during role play.	Student sometimes shows a variety of emotions during role play.	Student can show a variety of emotions during role play.
1B Recognize personal qualities and external supports.	Student cannot describe the qualities needed for a successful student.	Student can describe the qualities needed for a successful student.	Student can describe the qualities needed for a successful student and understands how and from whom they can ask for help when needed.
1C Demonstrate skills related to achieving personal and academic goals	Student cannot identify a personal area for growth.	Student can identify a personal area for growth, but is unsure how to approach the goal.	Student can identify a personal area for growth and describe the steps needed to achieve that goal, including addressing potential obstacles.
2A Recognize the feelings and perspectives of others.	Student cannot distinguish between verbal and non-verbal cues and messages.	Student can distinguish between verbal and non-verbal cues and messages.	Student can distinguish, describe, and label the differences between verbal and nonverbal cues and messages.
2B Recognize individual and group similarities and differences.	Student cannot describe the differences between humans in stories.	Students can describe the differences between humans in stories.	Students can describe the difference (including culture and social) between humans in stories and real life.
2C Use communication and social skills to interact effectively with others.	Student cannot express how they feel when they've been hurt emotionally.	Student can somewhat express how they feel when they've been hurt emotionally.	Student can express how they feel when they've been hurt emotionally while practicing reflective listening.
2D Demonstrate an ability to prevent, manage, and resolve interpersonal conflicts in constructive ways	Student cannot identify the consequences of a solution.	Student can identify the consequences of a solution.	Student can identify the consequences of a solution and identify passive, aggressive, and assertive conflict resolution behaviors.
3A Consider ethical, safety, and societal factors in making decisions.	Student cannot describe the consequences of breaking classroom or school rules.	Student can describe the consequences of breaking classroom or school rules.	Student can describe the consequences of breaking classroom or school rules and identify factors that make a situation unsafe.
3B Apply decision-making	Student cannot describe ways to	Student can describe ways to	Student can describe ways to

skills to deal responsibly with daily academic and social situations	promote the safety of themselves and others.	promote the safety of themselves and others.	promote the safety of themselves and others and generate alternative solutions to problems.
3C Contribute to the well-being of one's school and community.	Student cannot brainstorm ways to contribute to their community.	Student can brainstorm ways to contribute to their community.	Student can brainstorm ways to contribute to their community and develops a plan.

APPENDIX B

Teacher Survey

Directions: At the end of the study, please mark which category you believe is most appropriate for the statement. You may only choose one category per statement.

Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Responsive Classroom has positively impacted my classroom.					
I plan to use Responsive Classroom again next school year.					
I feel that Responsive Classroom took up too much academic time.					
My students overall behavior has improved because of Responsive Classroom.					
My students have improved academically because of Responsive Classroom.					
My students interactions with one another are more respectful because of Responsive Classroom.					
The majority of students' self-efficacy has increased since implementing Responsive Classroom.					

Which aspect of Responsive Classroom do you believe has most significantly impacted teaching and learning in your classroom? Why?

Additional Comments:

The Investigation of Hong Kong University Engineering Students' Perception of Help-seeking with Attitudes towards learning Simulation Software

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ABSTRACT
Simulation software has been integrated into education delivery process in order to provide an effective learning environment for students such as FlexSim and Arena. This study investigated Hong Kong engineering students' help-seeking perception and attitudes towards learning simulation software at their university education institution. Students can be influenced by different factors during their study of using simulation software and depends on different situations for determining their help-seeking perception. The objective of this survey is to examine the factors and situations that influenced students on using simulation software about its usage and acceptance, including the teaching and learning processes and the usage as a supplement to the conventional instruction. A survey will be conducted and collected samples from university students in one of Hong Kong's universities. A comparison will be made based on students' help-seeking perception and attitudes towards using simulation software (e.g. FlexSim or Arena) after collecting and analyzing those samples in order to provide a suggestion for improving the learning environment.
Keywords: Behavioral Intention, Goal orientation, Help-seeking, Perceived Usefulness, Self-regulation, Simulation software

INTRODUCTION
Based on the rapid development of technologies, interactive learning environments (ILEs) have influenced on the daily practice of education (Dillon & Gabbard, 1998; Koedinger, Anderson, Hadley, & Mark, 1997). Simulation software is seen to be a tool for enhancing the effectiveness of educational environment which is a program for user modeling an operation through the software without any actual performance. By using this simulation software, there are different functions and complicated structures for students to simulate some specific operation such as the operation of supply chain and manufacturing processes. Help-seeking performance would be made by using the simulation software because of the complex usages and techniques included in the software. Difficulties are made by the communication between the software program and human since the software has been identified as "thinking" differently from human (Rodgers & Moraga, 2011). A result shows that the relationship between help- seeking and academic need are connected (Karabenick & Knapp, 1988) which means academic result shows the degree of help-seeking from students. The academic result can be affected by the behaviors and attitudes of help-seeking to students. Ames (1983) has mentioned that students' help-seeking is not only depended on the pattern of attributions made about the task, also depend on the achievement goals. Learning attitudes can be reflected by students' help-seeking behavior (Arbreton, 1998). It shows a relationship between the help-seeking behavior and learning attitudes by students' achievement goals.

Simulation software has been implemented into the learning environment for students understanding more for applying their learning knowledge. Students can apply their knowledge learnt from lectures by simulating the software in order to get a great understanding of some specific concepts. Behavioral intention can be influenced by internal and external factors in different situations (Davis, 1989). It is worth to investigate the reasons and factors on the help-seeking performance from students with the use of simulation software. Besides, there is lack of research of finding the relative perception of help-seeking from students on using simulation software. Therefore, an understanding of cognitive, motivational and technological characteristics of student's academic help-seeking behavior is needed in order to recognize the factors that influence help-seeking in simulation software learning can help professors develop effective tools and techniques for enhancing students get interested in simulation software learning.

LITERATURE REVIEW

Definition of Academic Help-seeking

Help-seeking behaviors of learners reflect their metacognitive and specific knowledge skills (Newman, 1994; Puustinen, 1998; Wood & Wood, 1999). It can also be assumed that the help-seeking behaviors from the learners reflect their attitudes about learning and their achievement goals (Arbreton, 1998; Newman, 1998; Ryan & Pintrich, 1997). The academic result can be one of the achievement goals for students and assumed that it can reflect the learning attitudes based on their help-seeking behaviors. Besides, seeking help contributes to a general pattern of student's flexibility to overcome their difficulties for learning and achievement (Newman, 2000). It can be an important role in student's learning experience based on the challenges that online learning environment may develop (Dunn, Rakes, & Rakes, 2014). Learning changes individual' knowledge state and skill repertoire so that learners may seek help from others or other resources in order to solve problems they met since they are influenced directly and indirectly by their social and cultural circumstances and the why, what, when, where, and how of learning are not always decided by individual alone (Nelson, 1985). Learners need to obtain the necessary help for their learning through their classmates, instructors or other resources in order to meet their target problems.

A model of Help-seeking Process

A model of a Vygotskian framework is provided to understand help-seeking (e.g., Nelson-LeGall, 1981; Newman, 1994; Puustinen, 1998; Karabenick & Dembo, 2011). It can be a task analysis of the help-seeking process and comprises the following steps:

1. Meet a problem in learning and being aware of need for help.
2. Decide to seek help or not be considering the method of help-seeking.
3. Identify potential helpers if decided to seek help from someone.
4. Use strategies to elicit help to gain the greatest effort.
5. Contain getting help and evaluate the help gained.

The model was indicated by Nelson-LeGall (1981) and elaborated by Newman (1994).

Simulation Software

Simulation software is widely used as an instructional technology for providing training and basic operation to the university students (Sheingold & Hadley, 1990; Thomas & Hooper 1991). It provides powerful learning tools for students to understand the processes of an actual system. A real-life scenario is provided in the simulation and students can come across a number of real or idealized situations to observe and learn. Computer simulation enhances the active involvement of students in the learning process in order to facilitate their practice and mastery of concepts and principles (Rivers & Vockel, 1987).

According to Shannon (1975), simulation is the process of designing a model of a real operation and guiding experiments with the model for the purpose of understanding the operation or evaluating various strategies for the operation which means simulation is the process of simulating something or the result of simulating a specific operation. It also is defined in the handbook of simulation (1993), "simulation is the imitation of the operation of a real-world process or system over time to time." The major usage of simulation is to specify and study the behavior of a system or a process and be consider "what-if" questions related to the actual system performance.
The development of computer technology is related to the use of simulation modeling. The simulation modal is a computer program which realizes a huge number of computational operations. This means that the development of computers and simulation programs help to progress the field of simulation modeling methodology and its relative applications.

Nance (1996) has mentioned that there are five periods of developing the simulation. The first period of search (1955-69) is to facilitate the needs in simulation modeling. Problem-solving technique is being recognized into simulation languages to empower the functions of simulation. Secondly, the advent (1961-65) characters the appearance of indications of the major simulation programming languages that current in use. Thirdly, a consolidation in conceptual clarification are designed in the formative period (1966-70) in order to improve the clarity of simulation presentation to users. Fourthly, major expansions and extensions are developed during the expansion period (1971-78). Lastly, Simulation languages have been rarely extended and implemented to computers in the period of consolidation and regeneration (1979-86).

Characteristic of Simulation

Banks (1991) has classified five features of simulation software are input, processing, output, support, and cost. Input contains the ability to change the simulation language to another language if the simulators require the same model. It also involves syntax that made users understand the modeling terminology easily. Processing feature allows users entering the code to incorporate special characteristics in the model. Standardized and customized

reports are created by output feature. The standardized reports include performance procedures such as average time in queue and average utilization of resources while the customized reports include the display of specialized performance procedures and the tailoring of output for managers. The quality of documentation, animation capability, on- line help and tutorial, customer reports are belonging to support a feature. The final feature of the cost is difficult to determine because of the cost change. It is based on the outlay of the simulation and the hardware requirements. The time spending in learning the software and the time requiring in building the model are also involved in the cost feature.

FlexSim Simulation Software

FlexSim is developed by FlexSim Software Products Inc (Simulation software, n.d.) and is a program for creating discrete events simulations. The FlexSim consists of two programs which are basic simulation software FlexSim and FlexSim Healthcare Simulation (FlexSim HC). The OpenGL environment is the main functions of the program for rendering 3D images in real time. It simulates the work of a machine, conveyors, working men, robots, and forklifts. Students can use the simulation in trial version for free.

Arena Simulation Software

Arena is developed by the Rockwell Automation (Arena Simulation, n.d.) which enables the design of production lines. It helps demonstrating, predicting and measuring the system performances with the combination of process simulation and optimization. The program of Arena can simulate in two-dimensional (2D) and three-dimensional (3D). The 2D mode is used for the whole production process by applying the logical model since the duration and the speed of production are adapted in the simulation. After desiring the necessary functionalities, the related objects are created in 2D system and then updated to 3D environment. The benefits of using 3D animation are monitoring the arrangement of machinery, production line workers and demonstrates the whole process in the system. A final report is generated for each carried simulation.

METHOD

Students' help-seeking perception in university education can be influenced by several variables. Aleven et al. (2003) have identified learner-related factors that influence help-seeking behavior such as prior knowledge, self-regulation, age and gender, and goal orientation. Additionally, attitudes towards help-seeking are influenced by the social roles and cultural values which emphasize self-reliance and individual achievement (Nelson-LeGall, 1985). There are various models of technology acceptance used to understand the help-seeking perception of students. The Technology Acceptance Model is one of the most popular models and widely applied in the educational research. It helps to understand the reasons for individual favorable or not favorable to the technology. Thus, the model can be used to check students' help-seeking intentions in Simulation Software learning.

A. External Variables

Prior Knowledge Difference in Simulation Software Learning

Prior knowledge influences students' learning performance (Dochy & Alexander, 1995). An indirect effect included in the prior knowledge on learning through student behavior and study skill (Dochy & Segers, 2001). Other studies denoted that effective help-seeking is related to academic achievement and prior knowledge. Based on the research of Wood and Wood (1999), students with higher prior knowledge showed more effective help-seeking behavior while students with the lower prior knowledge required help more frequently. Their result showed that students with less prior knowledge made more errors and require more help. Similarly, students who have more knowledge about simulation software require less help from others. Less prior knowledge students may have less perceived ease of use of simulation software (e.g. FlexSim and Arena). Thus, the prior knowledge can be checked to understand the help-seeking perception of students based on their prior knowledge of simulation software learning (SSL).

H1: Students with prior knowledge require a positive effect on the Perceived Ease of Use (PEU) of the simulation software (e.g. FlexSim and Arena).
H2: Students with prior knowledge require a positive effect on the Perceived Usefulness (PU) of the simulation software (e.g. FlexSim and Arena).

Self-regulation in Simulation Software Learning

According to Levenyhal, Nerenz and Steele (1984), Self- regulation is defined as the ability to moderate the own thinking and feelings that affect one's behavior. Help-seeking can be defined as a strategy of self-regulated learning and self- regulated students tend to more control on their learning processes and academic outcomes (Newman, 1998). A study of Puustinen (1998) shows that the self- regulatory skills are related to the adaptive help seeking, so they tend to seek help more frequently than other students (Karabenick & Knapp, 1991). In the meantime, students with weaker self-regulatory skills tend to be lower prior knowledge because of the difficult task met with

their low prior knowledge. Accordingly, students with low prior knowledge of simulation software (e.g. FlexSim and Arena) learning are containing weaker self-regulatory.
H3: Prior Knowledge is different in self-regulatory skills.
H4: Students with self-regulatory skills have positive effect on the Perceived Ease of Use (PEU) in the Simulation Software Learning (e.g. FlexSim and Arena).
H5: Students with self-regulatory skills have positive effect on the Perceived Usefulness (PU) in Simulation Software Learning (e.g. FlexSim and Arena).

Goal Orientation in Simulation Software Learning
A course can be attracted by students leads to more oriented toward adopting mastery goals for giving the effort to learn more (Harackiewicz & Barron & Pintrich & Elliot & Thrash, 2002). Different goal orientations from students lead to different help-seeking behaviors. According to the study of Ryan and Pintrich (1997), they mentioned that the achievement goals can be divided into two motivational variables on help-seeking including direct and indirect effects. They indicated that Students with learning goals were more likely to require help from others while students with performance goals were more likely to perceive help- seeking as a threat to self-worth.

Thus, help-seeking performance approach of students on simulation software learning is exists in this study.
H6: Goal orientation of students have a positive effect on the Perceived Ease of Use (PEU) in Simulation Software Learning (e.g. FlexSim and Arena).
H7: Goal orientation of students have a positive effect on the Perceived Usefulness (PU) in Simulation Software Learning (e.g. FlexSim and Arena).

B. TAM Variables
Perceived ease of use and Perceived usefulness in Simulation Software Learning
According to Venkatesh and Davis (1996), the perceived usefulness can be affected by the perceived ease of use.
H8: A positive relationship involved in Perceived Ease of Use (PEU) and Perceived Usefulness (PU) in SSL.

Perceived Ease of Use and Attitude in Simulation Software Learning
The perceived ease of use is expected the degree of students using technologies and tools in Simulation Software Learning (SSL). It can be assumed that the easier of using techniques in SSL to a student may tend to perform a positive attitude in SSL.
H9: A positive relationship involved in Perceived Ease of Use (PEU) and Attitude (ATT) in SSL.

Perceived Usefulness and Attitude in Simulation Software Learning
In the study, the perceived usefulness (PU) of the Simulation Software Learning (SSL) is assumed students gain benefits more from the learning would perform well in the SSL courses.
H10: A positive relationship involved in Perceived Usefulness (PU) and Attitude (ATT) in SSL.

Attitude and Behavioral Intention in Simulation Software Learning
In the study, the attitude towards Simulation Software can refer the behavioral intention of the Simulation Software Learning (SSL). If students contain a good attitude towards Simulation Software, they tend to use more and support the SSL.
H11: a positive relationship involved in Attitude toward Using (ATT) and Behavioral Intentions (BI) in SSL.

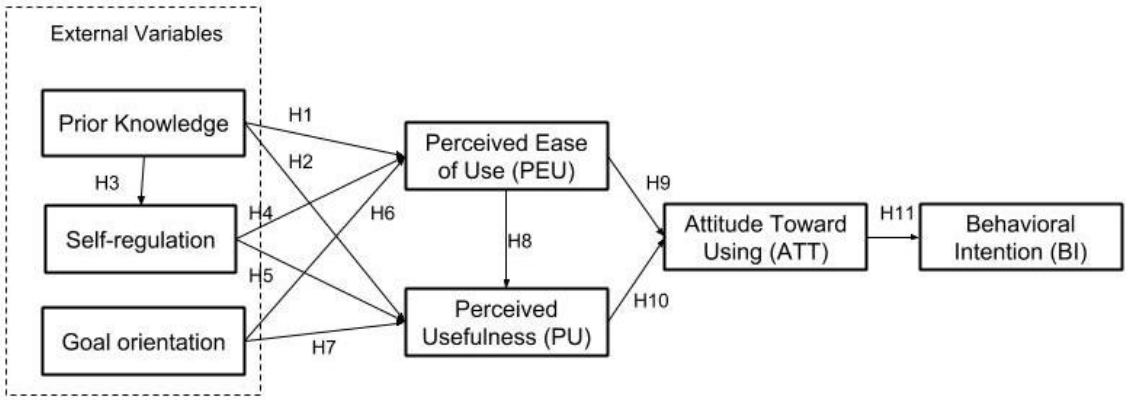

Figure 1. The Research Model of the study

FINDINGS

A questionnaire survey has been conducted into the project which aims to collect data for analysis students' help-seeking perception and attitudes towards using the simulation software (e.g. FlexSim or Arena) in their study. The survey focusses on the engineering students in one of Hong Kong's universities. The survey is going to divide into three major parts. They are personal information, student preferences for the methods of seeking-help from others and students' attitudes towards using simulation software for learning. Questions are designed based on students' experiences and their self-expectation. It has been designed twenty-eight questions in the survey for evaluating students' help-seeking perception and attitudes towards learning simulation software.

A. Population and Sample

Relevant data and questionnaires were collected from the target respondents. 150 questionnaires were distributed and 127 of them were returned and validated. Table 1 shows the demographic information of the target respondents.

Table 1. Demographic Characteristics of the Respondents

Individual Variables	**Frequency**
Gender of Respondents	
Male	54.3%
Female	45.7%
Study Year of Respondents	
Year 2	13.4%
Year 3	51.2%
Year 4	35.4%
Age of Respondents	
Below 20 years old	3.1%
20-23 years old	80.3%
24-26 years old	16.5%
Prior Knowledge of Respondents	
Have prior knowledge	11.8%
No prior knowledge	88.2%
Students' help-seeking Preferences from instructor in situation a	
Emailing instructor privately	30.7%
Calling instructor	1.6%
Asking instructor on discussion board	2.4%
Meeting instructor face-to-face	33.9%
No need to ask instructor	6.3%
Not comfortable asking instructor	25.2%
Students' help-seeking Preferences from instructor in situation b	
Emailing instructor privately	34.6%
Calling instructor	7.1%
Asking instructor on discussion board	0.8%
Asking instructor in live chat	1.6%
Meeting instructor face-to-face	29.9%
No need to ask instructor	6.3%
Not comfortable asking instructor	19.7%
Students' help-seeking Preferences from peer in situation a	
Emailing peers privately	2.4%
Calling peers	8.7%
Asking peers on discussion board	1.6%
Asking peers in live chat	43.3%
Meeting peers face-to-face	22.8%
No need to ask peers	9.4%
Not comfortable asking peers	11.8%
Students' help-seeking Preferences from peer in situation b	
Emailing peers privately	11.0%
Calling peers	4.7%
Asking peers in live chat	44.1%
Meeting peers face-to-face	23.6%

No need to ask peers	7.1%
Not comfortable asking peers	9.4%

B. Data Collection Method & Analysis

The questionnaire was divided into three parts. The first part included the basic personal information about the respondents. The second part was inquiring five questions related to students' prior knowledge of simulation software, and students' help-seeking preferences from instructors and peers during the learning process of simulation software, and asked the students' preferred methods of contracting the instructors or peers in two situations. The two situations are mentioned in the last four questions a) when they are confused about the concept of a subject matter in a simulation software learning, and b) when they are confused about the guidelines for completing an assignment, meet a due data, a grade or other similar procedures in a simulation software learning. The third part contained eighteen questions inquiring students' attitudes towards simulation software learning.

The questionnaires were distributed after the lectures. Found the target respondents based on the AIMS of this university for checking the lectures timeslots of engineering students. Then, invited them for completing the questionnaires after the lectures. Before distributing the questionnaires, they were asked whether they have experiences of learning the simulation software. If not, the questionnaires would not be distributed to them. Feedback was given from the respondents to understand more about the purpose of this survey. The validated questionnaires ensured the respondents are experienced in simulation software learning. The data was evaluated and presented in the regarding tables.

C. Data Analysis & Findings

The descriptive statistics was shown in Table 2 to give a summary of the information about the items used in the survey. There were eighteen items listed in Table 2 by using five-point Likert-scale (1 = strongly disagree to 5 = strongly agree), including students' help- seeking perception factors and attitudes toward learning Simulation Software. Each factor contained three statements in the questionnaire for asking students' experiences.

Table 2. Questionnaire Items

Items	Mean	STD. Deviation
I found the Simulation Software (e.g. FlexSim or Arena) easy to use.	2.74	0.657
It is easy to use the Simulation Software (e.g. FlexSim or Arena) in improving my academic performance.	2.59	0.694
It is easy to use Simulation Software (e.g. FlexSim or Arena) as a tool for learning.	2.61	0.644
Using the Simulation Software (e.g. FlexSim or Arena) easy to enhance my learning effectiveness.	3.03	1.061
Using the Simulation Software (e.g. FlexSim or Arena) as an easy tool for learning in classroom to increase my learning and academic performance.	2.98	0.908
The learning of Simulation Software (e.g. FlexSim or Arena) is useful in supporting my learning.	3.02	0.959
I can perform better while learning the Simulation Software (e.g. FlexSim or Arena).	2.74	0.681
I am satisfied with the learning content of the Simulation Software (e.g. FlexSim or Arena).	2.52	0.688
I feel enjoyable every time when I learn the Simulation Software (e.g. FlexSim or Arena).	2.74	0.769
Given the opportunity, I would use the Simulation Software (e.g. FlexSim or Arena) as a learning tool in the future.	2.73	0.672
I would recommend other to use the Simulation Software (e.g. FlexSim or Arena) as a learning tool.	2.35	0.717
I would like to use the Simulation Software (e.g. FlexSim or Arena) as a learning tool.	2.58	0.761
When I meet a problem in Simulation Software learning (e.g. FlexSim or Arena), I will require help from my teacher.	2.90	0.733
When I meet a problem in Simulation Software learning (e.g. FlexSim or Arena), I will require help from my classmate.	2.57	0.751
When I meet a problem in Simulation Software learning (e.g. FlexSim or Arena), I will find solution from proper websites (e.g. Google search).	2.83	0.714

I believe that I can get excellent grades on Simulation Software learning (e.g. FlexSim or Arena).	2.97	0.796
I believe that I can capture the basic concepts taught in Simulation Software learning course (e.g. FlexSim or Arena).	2.65	0.706
I believe that I can understand the most difficult part of Simulation Software materials (e.g. FlexSim or Arena).	2.24	0.707

Factor analysis is used for testing the variability of this study. It aims for observing the variable were correlated to each other. The similarity and relation of the target group for ensuring the data collected is associated with the scale, and reduce the number of variable to facilitate the supplementary analysis. The data was tested by the factor loading and corrected item-total correction. To access the significance of factor loadings, factor loadings of 0.3 to 0.4 are minimally accepted (Hair et al., 2010) which means the data was variable while the value of factor loading and the corrected item-total correction is more than 0.3. The factor loading in the variable items ranged from 0.414 to 0.795 which means that data was variable to the study.

Furthermore, The Cronbach's alpha is adopted in this study to provide a measure of the internal consistency of a scale. The value of the Cronbach's alpha is presented as a number between 0 and 1. There are serval reports indicated different acceptable values of alpha, ranging from 0.7 to 0.95 (Bland & Altman, 1997; DeVellis, 2017). However, a maximum alpha value of 0.9 has been recommended (Streiner, 2003). Thus, the alpha value low than 0.7 could be the low value of due to a low number of question, poor interrelatedness between items (Tavakol & Dennick, 2011). The low value of alpha should be discarded. The Cronbach alpha value of Table 2 was 0.849 which was accepted in the range of 0.7 to 0.95.

The study is to observe Hong Kong engineering university students' help-seeking performance and attitudes towards Simulation software learning. By analyzing the collected data from the questionnaires, different results were found based on the research model and tested by the Statistical Package for Social Sciences software (SPSS). The analysis methods included Independent Sample T-test and Pearson Correlation. All hypotheses were tested based on students' experience of FlexSim and Arena.

Table 3. Test of Hypothesis H1

Sig F	F	Sig t	t
0.197	1.680	2.135	0.035

Based on the result of Independent T-test in Table 3 ($p=0.035<0.05$), a significant difference appeared between students with prior knowledge and without prior knowledge of Simulation Software learning. The mean value for students with related prior knowledge was 2.8889 while students without related prior knowledge was 2.6131, which means students with related prior knowledge perceived using the software easier.

Table 4. Test of Hypothesis H2

Sig F	F	Sig t	t
0.355	0.862	2.625	0.010

The mean value of students with prior knowledge was 3.4444 and greater than the students without prior knowledge of simulation software (2.9524). Based on the Table 4 ($p=0.010<0.05$), there was a significant prior knowledge difference about students perceived usefulness in simulation software learning.

Table 5. Test of Hypothesis H3

Sig F	F	Sig t	t
0.223	1.498	2.491	0.014

The mean value of self-regulated students with prior knowledge was 3.0889 which greater than self-regulated students without prior knowledge (2.7232). Based on the Table 5 ($p=0.014<0.05$), there was a significant difference between self-regulated students with or without prior knowledge of simulation software learning.

Table 6. Test of Hypothesis H4

Pearson Correlation (r)	Sig. (2-tailed)	N
0.555	0.000	127

** Correlation is significant at the 0.01 level (2-tailed)

Based on Table 6, the value of r was 0.555 (p=0.000<0.05) which was greater than 0.5 and would be classified as a strong positive correlation between self-regulatory and perceived ease of use of simulation software learning.

Table 7. Test of Hypothesis H5

Pearson Correlation (r)	Sig. (2-tailed)	N
0.707	0.000	127

** Correlation is significant at the 0.01 level (2-tailed)

Based on Table 7, the r value was 0.707 (p=0.000<0.05) which means that a strong relationship occurred between students' self-regulatory and perceived usefulness of learning simulation software.

Table 8. Test of Hypothesis H6

Pearson Correlation (r)	Sig. (2-tailed)	N
0.526	0.000	127

** Correlation is significant at the 0.01 level (2-tailed)

Based on Table 8, the r value was 0.526 (p=0.000<0.05) which showed a positive relationship between the goal orientation and the perceived ease of use from the learning of simulation software to students.

Table 9. Test of Hypothesis H7

Pearson Correlation (r)	Sig. (2-tailed)	N
0.639	0.000	127

** Correlation is significant at the 0.01 level (2-tailed)

Based on Table 9, the r value was 0.639 (p=0.000<0.05) which showed the strong relationship between the goal orientation of students and students' perceived usefulness of learning simulation software.

Table 10. Test of Hypothesis H8

Pearson Correlation (r)	Sig. (2-tailed)	N
0.632	0.000	127

** Correlation is significant at the 0.01 level (2-tailed)

Based on Table 10, a positive relationship was occurred between perceived ease of use and perceived usefulness of simulation software toward students' learning as the r value was 0.632 (p=0.000<0.05).

Table 11. Test of Hypothesis H9

Pearson Correlation (r)	Sig. (2-tailed)	N
0.402	0.000	127

** Correlation is significant at the 0.01 level (2-tailed)

Based on Table 11, a positive relationship was formed between the perceived ease of use and the attitudes of students learning simulation software as the r value was 0.402 (p=0.000<0.05).

Table 12. Test of Hypothesis H10

Pearson Correlation (r)	Sig. (2-tailed)	N
0.396	0.000	127

** Correlation is significant at the 0.01 level (2-tailed)

In Table 12, the r value was 0.396 (p=0.000<0.05) which showed a positive relationship between the perceived usefulness and attitudes toward students learning simulation software.

Table 13. Test of Hypothesis H11

Pearson Correlation (r)	Sig. (2-tailed)	N
0.580	0.000	127

** Correlation is significant at the 0.01 level (2-tailed)

In Table 13, the r value was 0.580 whereas the p value was 0.000 (p<0.05), showed a positive relationship between the students' attitudes toward simulation software learning and behavioral intention of using simulation software.

CONCLUSION AND EVALUATION

Engineering university students' perception of help-seeking and attitudes toward simulation software (e.g. FlexSim or Arena) in Hong Kong has examined in this study. Students preferences of help-seeking in simulation software learning have been researched through the survey with the use of modified Technology Acceptance Model (TAM). The analyzed data has been mentioned in different tables. The independent sample t-test and Pearson correlation have been used in the study for analyzing the data collected from the survey. They have been used for checking and testing the relationship and effect across different variables.

Most of the variables have been tested and supported. Based on the result of the data analysis, there were significant impacts and connections on student's perception and their attitude toward simulation software learning among their prior knowledge, self-regulation, and goal orientation which also influenced their help-seeking behavior in learning simulation.

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Turkish Teacher Candidates' Opinions on Story and Tale Telling Course

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ABSTRACT
In order for the fairy tale to maintain its effect on individuals, it must be transmitted to future generations in different ways. One of these transmitters is the storytellers. With the use of fairy tales in activities for basic language skills, fairy tales have become an important part of Turkish language teaching. Thus, Turkish teachers directly or indirectly assume the role of storytellers. For this reason, the opinions of Turkish teachers or prospective Turkish teachers about storytelling are important. In this study, it is aimed to reveal the opinions of prospective Turkish teachers about story and tale telling course. Phenomenological (phenomenological) design, one of the qualitative research designs, was used in the study and hermeneutic (interpretive) model, one of the types of phenomenological design, was used. The research was carried out on 26 3rd grade students continuing their education in the Department of Turkish Language Teaching at Bayburt University Faculty of Education in the autumn term of the 2022-2023 academic year. A semi-structured interview form consisting of 7 questions was used to determine their views on the "Story and Tale Telling" course. Content analysis technique was used to analyse the collected data. According to the opinions of prospective Turkish teachers, story and tale telling course is very important for prospective teachers.

INTRODUCTION

Text types have an significant place in the individuals' lives. One of these genres is tales. The tale, whose origin comes from the Arabic word mesel, is a literary genre based on oral narrative in which extraordinary events are told through extraordinary heroes, the time and place elements are not clear, and the good guys definitely win in the end. Çetinkaya (2007) defines the tale, which can be told in verse or prose, as a literary genre that includes genre-specific formals at the beginning, middle and end, whose heroes are human, animal and extraordinary beings, which reveals extraordinary events, which takes place in an indefinite space and time called "tale world", which is told to adults and children in different environments, whose purpose is to entertain, educate and advise, and which is produced mostly orally and some in writing.

The tales, whose existence dates back to the beginning of human history, guide individuals at every occasion (Akın & Akın, 2021). Thanks to its extraordinary nature, enriching the imagination of individuals, and harmony in its language, tales directly support individuals' cognitive, linguistic, personality development, social and affective development. These features have made the tale one of the permanent elements in the education of individuals and the tale has been used in both formal and non-formal education (Akın & Akın, 2021).

The tale, which creates an effective and qualified educational environment, meets with the reader, especially with Turkish education, and thus can be transferred to future generations (Temizyürek & Vargelen, 2016).

Through tales, individuals develop four basic linguistic skills and the ability to use language effectively. However, their vocabulary is also enriched. The expression power of individuals whose vocabulary is enriched also improves. Individuals can improve their skills such as problem solving and empathizing with tales; different social values can be gained through tales based on the basic teaching of the tale that the good person wins.

In order for the tale to maintain its effect on individuals, it must be passed on to future generations in different ways. One of these ways is the transfer of tales, which are products of oral culture, from language to language (Akın & Akın, 2021). Tale tellers are one of those who transfer this. In the past, narrators or mothers called tale grandmothers were well versed in tale narration, and they ensured the education of children with tales (Rado, 1982). A tale teller is someone who codifies the tale according to the context in which it is told, the target audience and transfers it from generation to generation with the strength of the word. In tale-telling, which is accepted among the performing arts, the narrator puts forth a performance based on stage presentation. In his performance, he conveys the events with words, gestures and mimics, often improvising (Topçam, 2019). With the tale or story told, individuals both have fun and culture transfer takes place.

Tale tellers should have the skills of using the voice and breath correctly, using gestures and facial expressions

effectively, taking into account the characteristics of the target audience, mastering the tale, recognizing and using storytelling techniques, as they have to convey the linguistic structures of oral culture in a style appropriate to the genre, paying attention to gestures and facial expressions (Oruç & Çağır, 2020). Since tale telling is a performance-based activity that requires skill, it is expected from the tale teller to be familiar with telling techniques and to be a performer who can revitalize the tale (Azadovski, 2002). In addition, the tale teller is asked to internalize the tale to be told in the preparation phase, make preparations before the narration, and plan the seating arrangement (Kılıç, 2019; Oruç & Çağır, 2020).

It is also very important for the tale teller to prepare the tale map with the tale structure within the scope of tale preparation, to create the practices of visiting the tale place and talking to the hero. Knowing the physical, social and psychological characteristics of the tale hero; mastering the details of the tale place directly affects the narration performance of the tale teller. For this reason, the narrator should imagine how the heroes dress, what they eat and where they live (Oğuz & Özünel, 2017).

The narrator creates a tale structure consisting of 8-10 sentences at the beginning, followed by 3 sentences expressing the exposition, knot and solution sections, and finally a single sentence that reveals the main idea of the tale in order to keep the flow of events in his mind during the storytelling. While preparing the tale structure, he or she concentrates on the sine qua non of the event fiction of the tale (Kılıç, 2019).

One of the points to be considered by the narrator is the use of a fluent and understandable language in tale telling. For this, the characteristics of the audience should be taken into account, eye contact should be established with the audience, the narration should be supported with gestures and mimics without overdoing it, and the tone of voice should be adjusted according to the environment (Güleryüz, 2003; Sakaoğlu, 2014).

The tradition of telling tales preserves its place in the past even today. In schools, tales can be a part of educational activities from time to time (Akın & Akın, 2021). The correct and effective use of the native language, which is among the main objectives of Turkish language teaching, requires the development of basic language skills. At this point, text types come to the fore. Among the genres, the place of tales is very important (Çetinkaya Z. , 2007). Tales are among the first genres that give individuals the opportunity to encounter the most beautiful examples of the native language in early childhood and even infancy. This situation makes children interested in tales as a genre and strengthens the bond between the child and the tale.

In the literature review on storytelling, there are some studies conducted both in Turkey and abroad.

Uç (2022) examined the opinions of preschool teachers who received Anatolian tale telling training and found that tale telling supports language development, social emotional development, motor development, supports the classroom environment and the organization of relationships, increases students' curiosity, and contributes to classroom management in terms of time management.

Oruç & Çağır (2020) evaluated tale telling according to the perspective of the narrators and revealed the characteristics that should be found in the tale teller. In the study, which evaluates tale telling and storytelling in the modern sense according to the teacher's perspective, it was revealed that storytelling and tale telling trainings are not yet at the desired level academically and methodologically based on the data collected from individuals who perform tale telling and educational institutions that provide this training (Çeker, 2020). Akın & Akın (2021) found that teachers agree on the importance of tales and their inclusion in curricula, but that tales are not sufficiently utilized.

Gazioğlu (2021), who looked at the effect of tale telling on listening skills with a multi-sensory learning-based approach, concluded that tale telling had a positive effect on 5th grade students' attitudes towards listening to tales. Erdal (2020) found that problem-solving training supported by storytelling had positive effects on 5-year-old children. Çelik (2022) examined the effect of storytelling on language development and found that interactive tale telling is an effective tool to support language development. There are also studies that reveal that tale telling is effective in transferring values in preschool students (Önder & Kanak, 2017). Wee, Kim, & Lee (2019) found that tale time in early childhood positively affected children's critical literacy approaches. Guo (2018) looked at the effect of tale use on educational strategies in preschool students and found that folk tales positively affect children's development.

Studies on pre-service teachers and tales are also seen in the literature. Temizyürek & Vargelen (2016), who wanted to evaluate the awareness of pre-service Turkish teachers, determined that pre-service teachers had a high awareness of tales, but they did not have sufficient knowledge about the content of the tale genre. Yazıcı &

Göktentürk (2019) examined the opinions of prospective Turkish teachers on the use of stories in Turkish language teaching and stated that prospective teachers stated that stories can be used to develop students' spirituality, gain reading habits, develop fluent reading skills, and get away from exam stress and pressure (Batur & Alkan, 2020).

When the literature is reviewed, it is seen that there is no study that directly associates Turkish teacher candidates with tale telling. With the use of tales in activities for basic language skills, tales have become an important part of Turkish language teaching. Thus, Turkish teachers directly or indirectly assume the role of tale tellers. For this reason, the opinions of Turkish teachers or prospective Turkish teachers about tale telling are important. In this study, it is aimed to reveal the opinions of prospective Turkish teachers about storytelling and tale telling course. For this purpose, the following questions were answered:

For Turkish teacher candidates;
1. What are their opinions about the course before taking the "Story and Tale Telling" course?
2. What are their opinions about the course after taking the "Story and Tale Telling" course?
3. What are their opinions about "Story and Tale Telling" being an optional course?
4. What are their opinions about the contribution of "Story and Tale Telling" course to their teaching careers?
5. What are their criticisms and suggestions about the content of "Story and Tale Telling" course?
6. What are their opinions on whether there is a need for the "Story and Tale Telling" course in the undergraduate program?
7. With which concept do they explain their perceptions of the "Story and Tale Telling" course?

METHOD

In this section, explanatory information about the research design, study group, data collection and analysis process is given.

Research Model

Phenomenological design, one of the qualitative research designs, was used in the study and hermeneutic (interpretive) model, one of the types of phenomenological design, was utilized. In phenomenological research, the "phenomenon" to be investigated within the scope of the study is emphasized and the perceptions and perspectives of the participants in the study group regarding this phenomenon and how they make sense of and experience the phenomenon in question are emphasized (Tekindal & Arsu, 2020). In the research, the opinions of prospective Turkish teachers about the "Story and Tale Telling" course were emphasized.

Study Group

The research was conducted on 26 third-year students who continue their education in the Department of Turkish Language Teaching at Bayburt University Faculty of Education in the fall semester of the 2022-2023 academic year. In the selection of the study group, convenience sampling method, one of the purposeful sampling methods, was preferred. In this convenience sampling method, the researcher prefers the situation that is close to himself or his environment in terms of access (Yıldırım & Şimşek, 2013). The participants who constituted the study group of the research participated in the research voluntarily. Information about the students in the study group is given in the table:

Table 1: The demographics of the recruited study participants

Gender	f	%
Male	9	35
Female	17	65
Total	26	100

Data Collection

In the study, a personal information form was used to obtain data on the gender of the study group and a semi-structured interview form consisting of 7 questions was used to determine their views on the "Story and Tale Telling" course.

In semi-structured interviews, researchers can collect detailed data by changing the flow and content according to the answers given by the interviewee during the question-answer period (Çınkır & Demirkasımoğlu, 2015). In the development of the interview form, questions that could be included in the interview form were prepared by reviewing the literature on tale telling and Turkish teacher candidates. In order to evaluate the draft form in terms of its suitability for the purpose of the research, comprehensibility and applicability, the opinions of two doctoral

faculty members working in the field of Turkish language teaching were taken from the field experts. According to the opinions, the draft form was reorganized and the interview form was tested by interviewing two Turkish teacher candidates, and then the semi-structured interview form was finalized.

The research data were collected in the fall semester of the 2022-2023 academic year using the semi-structured interview form developed by the researcher. Permission was obtained from Bayburt University Ethics Committee for data collection. After the permission, the place and time of the interview were determined by reaching the pre-service teachers in the study group. The interviews, which lasted approximately 10-15 minutes, were first recorded, then the recordings were transcribed and the raw data of the research were kept and external reliability was increased.

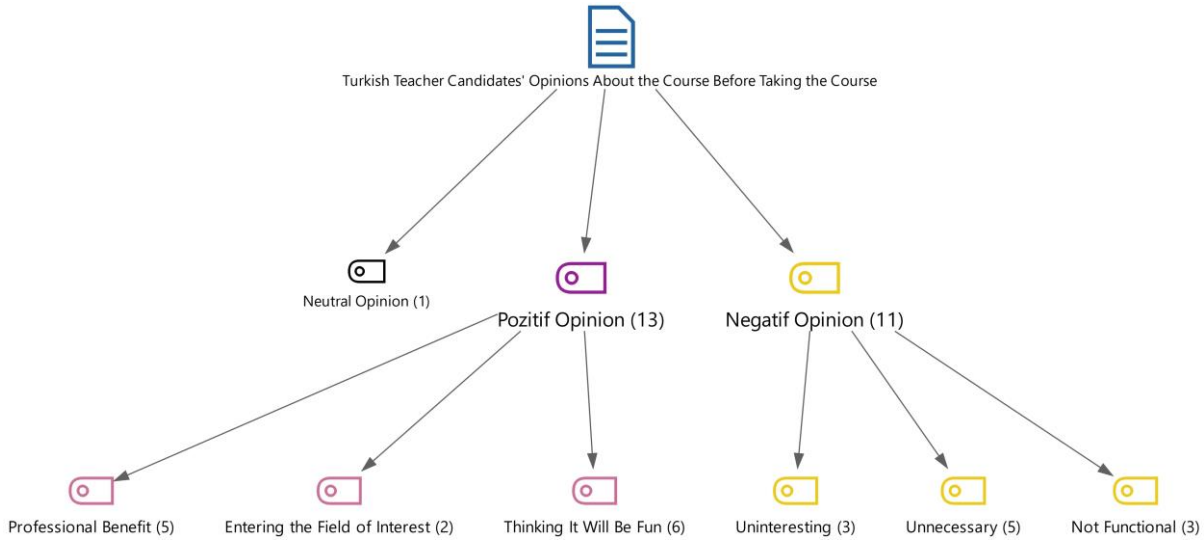
Data Analysis

Content analysis technique was used to analyze the data collected within the scope of the research. In content analysis, the expressions in the text are divided into smaller contents and summarized systematically by coding within a certain rule (Büyüköztürk, Çakmak, Akgün, Karadeniz, & Demirel, 2017). The data obtained after the interview were coded separately by both the researcher and the expert who worked as a Turkish teacher trained in tale-telling. The codings were compared and the consistency between the codings was calculated using the formula for the amount of agreement (Miles & Huberman, 1994). (Tavşancıl & Aslan 2001). The percentage of agreement between the two coders was 87%. In line with these procedures, data analysis was completed and the findings of the study were obtained.

FINDINGS

Findings Related to the First Sub-Problem

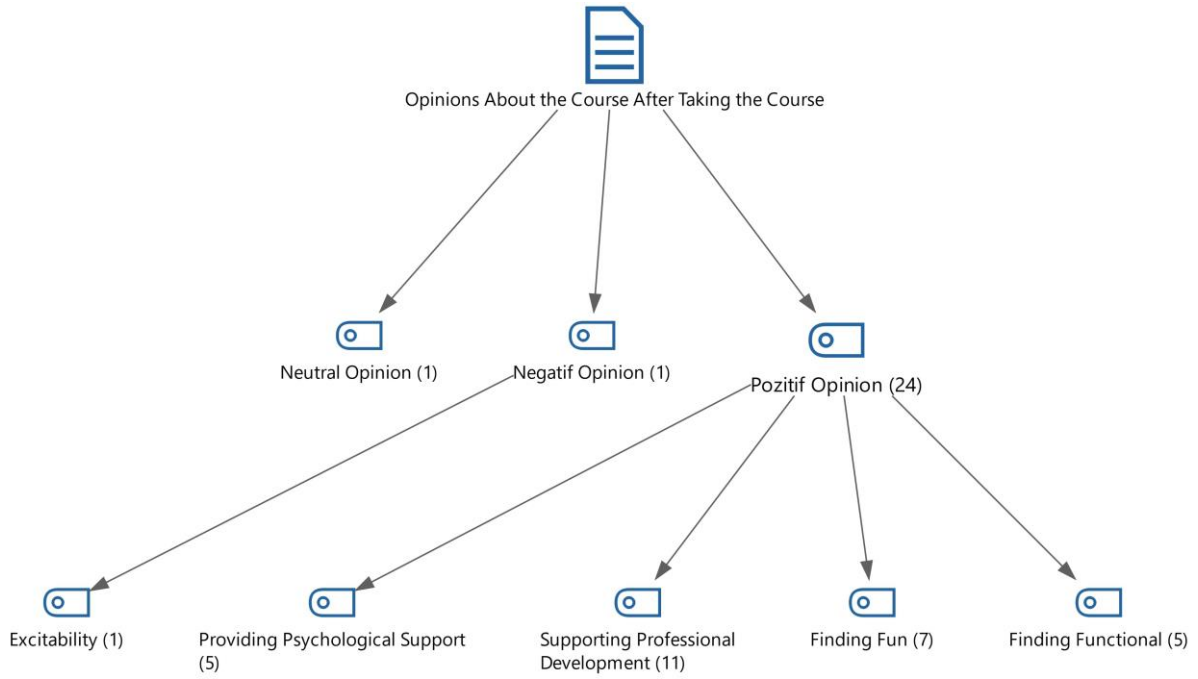
What are their opinions about the course before taking the "Story and Tale Telling" course?" The answers given by the prospective Turkish teachers to the research question were described. Interview forms were used in the description and the data obtained were analyzed in Maxqda©. The code map of the themes obtained as a result of the analysis is presented in the figure:



As seen in the figure, it is possible to analyze the opinions of prospective Turkish teachers about the course before taking the course under three main themes: (1) positive opinion, (2) negative opinion and (3) neutral attitude. When the data collected under the theme of positive opinion are detailed, the idea that it will be an entertaining course, the belief that it will provide professional benefits and being in the field of interest are dominant in Turkish teacher candidates. When the data collected under the negative opinion theme are detailed, it is seen that Turkish teacher candidates consider it unnecessary, uninteresting, and not functional. In the data under the neutral theme, prospective Turkish teachers did not express a positive or negative opinion.

Findings Related to the Second Sub-Problem

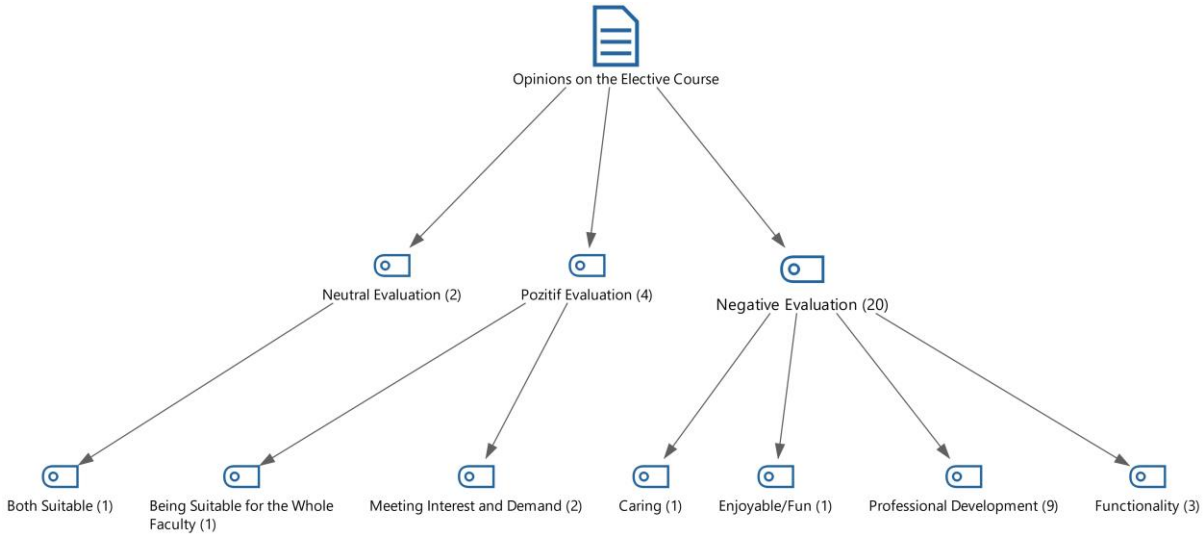
What are their opinions about the course after taking the "Story and Tale Telling" course?" The answers given by the prospective Turkish teachers to the research question were described. Interview forms were used in the description and the data obtained were analyzed in Maxqda©. The code map of the themes obtained as a result of the analysis is presented in the figure:



As seen in the figure, it is possible to analyze the opinions of prospective Turkish teachers about the course after taking the course under three main themes: (1) positive opinion, (2) negative opinion and (3) neutral attitude. It is seen that the data collected under the theme of positive opinion show an increase compared to the situation before taking the course. When the data are detailed, the belief that the course provides professional benefits, the idea that it is a fun course and the view that the course is quite functional are dominant in Turkish teacher candidates. On the other hand, it was also stated that the course provided support at the point of psychological anxiety. When the data collected under the negative opinion theme are detailed, the idea that the course increases excitement was expressed in the Turkish teacher candidates. In the data under the neutral theme, the prospective Turkish teacher did not declare that there was no change before and after the lesson.

Findings Related to the Third Sub-Problem

What are the opinions of the prospective Turkish teachers about the "Story and Tale Telling" course being an elective course?" The answers given by the prospective Turkish teachers to the research question were described. Interview forms were used in the description and the data obtained were analyzed in Maxqda©. The code map of the themes obtained as a result of the analysis is presented in the figure:

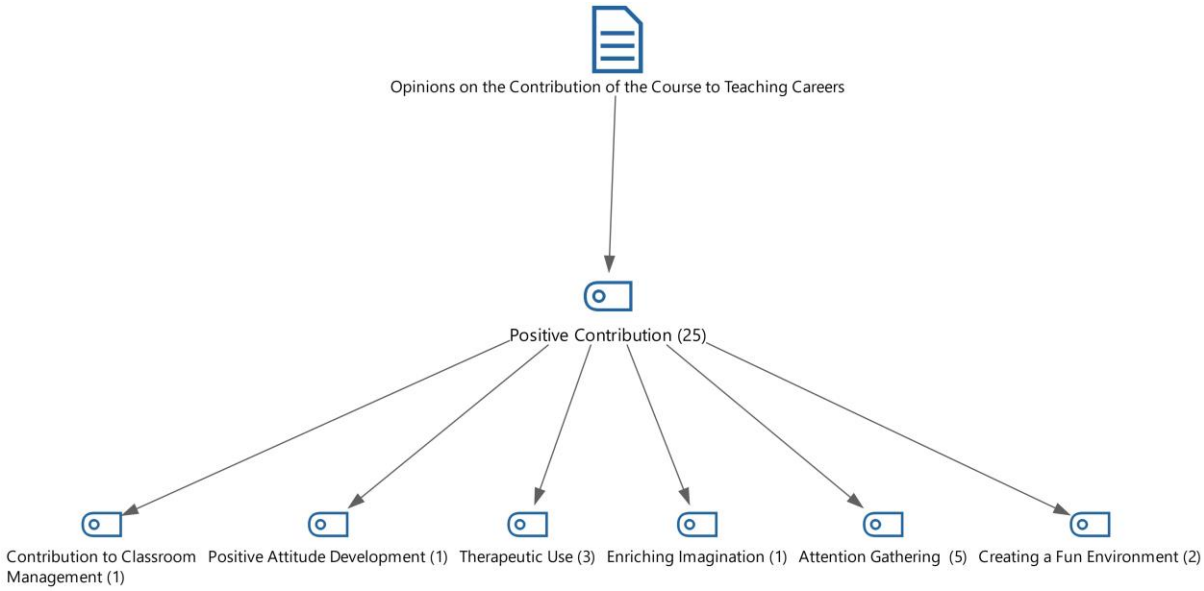


As can be seen in the figure, it is possible to analyze the opinions of prospective Turkish teachers about the elective course under three main themes: (1) negative evaluation, (2) positive evaluation and (3) neutral attitude. When the data collected under the theme of negative evaluation are analyzed in detail, it can be seen that

prospective Turkish language teachers have a negative attitude towards the story and tale telling course being an elective course considering their professional development and the functionality of the course. Those who have a positive attitude towards being an elective course see the current state and situation of the course as sufficient. In the data under the neutral theme, the Turkish teacher candidate stated that the course could be elective or compulsory.

Findings Related to the Fourth Sub-Problem

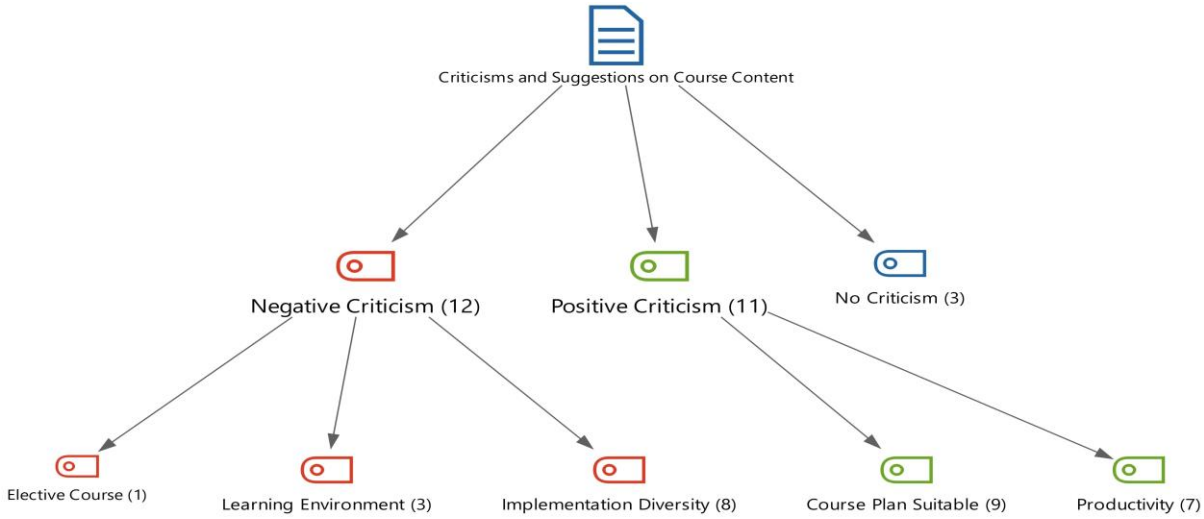
What are the opinions of the prospective Turkish teachers about the contribution of the "Story and Tale Telling" course to their teaching careers?" The answers given by the prospective Turkish teachers to the research question were described. Interview forms were used in the description and the data obtained were analyzed in Maxqda©. The code map of the themes obtained as a result of the analysis is presented in the figure:



As can be seen in the figure, the opinions of prospective Turkish teachers about the contribution of the course to their teaching careers (1) are in the direction of positive contribution. When the data collected under the theme of positive contribution are elaborated, enriching the learning environment, and attention gathering come to the fore.

Findings Related to the Fifth Sub-Problem

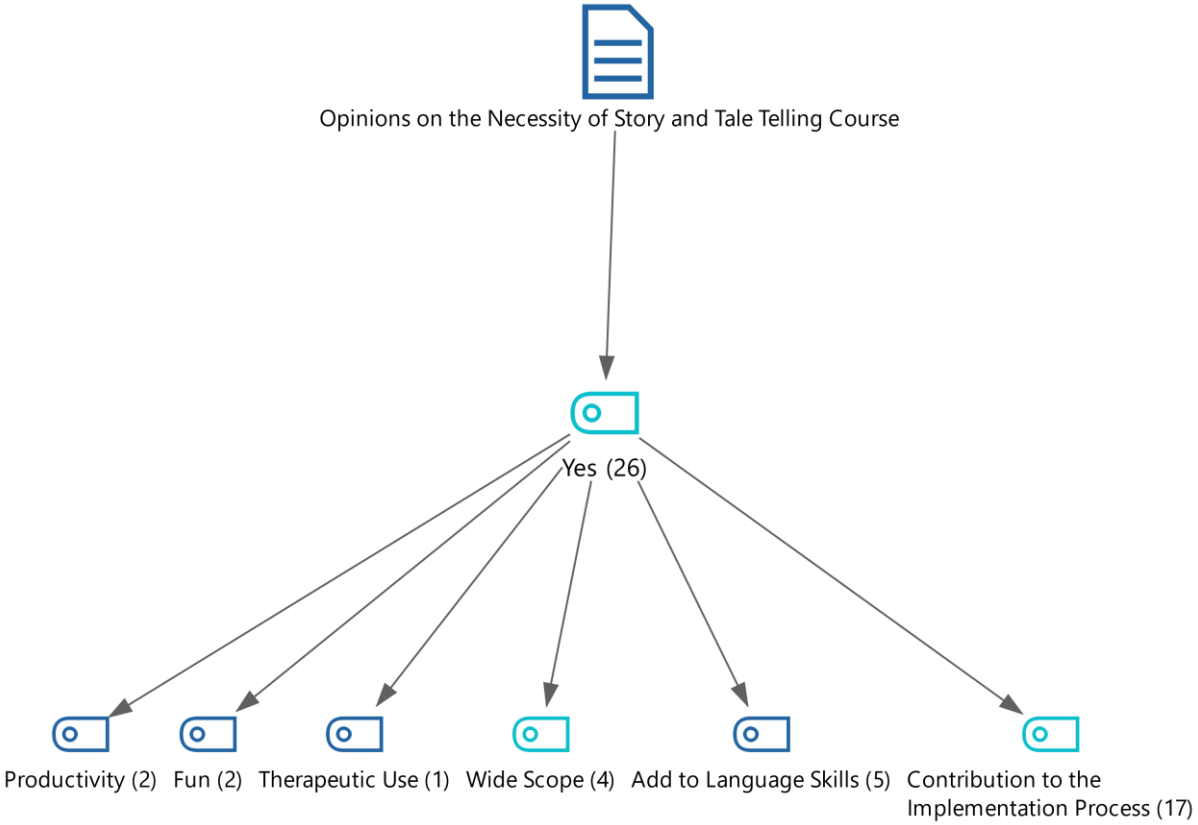
What are their views on criticisms and suggestions about the content of the "Story and Tale Telling" course?" The answers given by the prospective Turkish teachers to the research question were described. Interview forms were used in the description and the data obtained were analyzed in Maxqda©. The code map of the themes obtained as a result of the analysis is presented in the figure:



As can be seen in the figure, it is possible to examine the opinions of prospective Turkish teachers about their criticisms and suggestions about the course content under three main themes: (1) negative criticism, (2) positive criticism and (3) no criticism. When the data collected under the theme of negative criticism are detailed, prospective Turkish teachers criticized the implementation process and enriching the learning environment and found it negative that the course was an elective course. On the other hand, those who expressed positive criticism saw the current course as sufficient in terms of lesson plan and content and stated that they found the course productive for this reason. In the data under the theme of no criticism, the prospective Turkish teacher stated that the current course does not require criticism.

Findings Related to the Sixth Sub-Problem

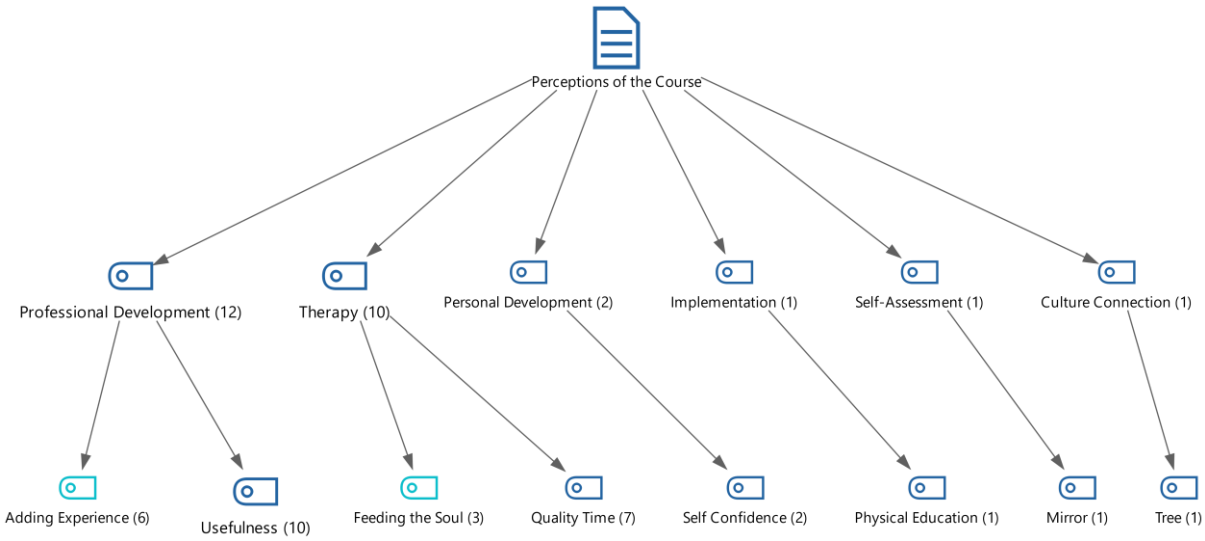
What are their views on the necessity of the "Story and Tale Telling" course?" The answers given by prospective Turkish teachers to the research question were described. Interview forms were used in the description and the data obtained were analyzed in Maxqda©. The code map of the themes obtained as a result of the analysis is presented in the figure:



As can be seen in the figure, the opinions of prospective Turkish teachers about the necessity of the course are gathered under the main theme (1) yes. As the reason for this situation, the application dimension of the course comes to the fore. In addition, contributing to language skills, its scope, being fun, being productive and using it for therapeutic purposes are other points that draw attention.

Findings Related to the Seventh Sub-Problem

With which concept do they explain their perceptions of the "Story and Tale Telling" course?" The answers given by the prospective Turkish teachers to the research question were described. Interview forms were used in the description and the data obtained were analyzed in Maxqda©. The code map of the themes obtained as a result of the analysis is presented in the figure:



As can be seen in the figure, it is possible to analyze the perceptions of prospective Turkish teachers about the course under six main themes: (1) professional development, (2) therapy, (3) personal development, (4) cultural relationship, (5) self-evaluation and (6) practice. The data gathered under the theme of professional development is primarily related to the idea of adding experience and being useful. Regarding the theme of therapy, the perception of spending quality time and feeding the soul is dominant. On the other hand, the perception of self-confidence at the point of personal development was mentioned in the opinions.

CONCLUSIONS AND DISCUSSION

Before the prospective Turkish teachers understand the story and tale telling course, they consider the course unnecessary, they do not find the course very functional and the course does not attract their interest. However, there are also those who think that the course will be a fun course and will provide professional benefits. A similar difference is also observed in Akın & Akın's (2021) study. According to the results of the study, while some of the teachers consider themselves as tale tellers, some of them do not consider themselves as tale tellers.

In the opinions of prospective Turkish teachers about the course after taking the course, providing professional benefits, being a fun course, functionality and reducing anxiety come to the fore. On the other hand, it was also stated that the course provided support at the point of psychological anxiety. It was observed that the negative opinions stated before the course decreased. In the recommendations of Oruç & Çağır (2020), it is recommended that training on tale telling techniques be given effectively to prospective teachers at universities. This recommendation coincides with the positive opinions of prospective Turkish teachers about the course.

Considering the effect of the course on their professional development and the functionality of the course after taking the course, prospective Turkish teachers have a negative reaction to the story and tale telling course being an elective course and state that it may be compulsory. In the suggestions in the literature, both in Turkish education departments and in other departments that train teachers, the inclusion of tales and tale telling practices stands out (Temizyürek & Vargelen, 2016; Yazıcı & Göktentürk, 2019; Batur & Alkan, 2020). Batur & Alkan (2020) asked prospective teachers whether there should be an independent course on tales in undergraduate education and the majority of them stated that there is a need for an independent course focused on tales.

The contributions of the course to their teaching careers were enriching the learning environment and focusing attention. In a study on the use of tales in Turkish lessons, the view that tales enrich the learning environment was adopted (Çetinkaya Z. , 2007).

In the criticisms and suggestions regarding the course content, Turkish teacher candidates wanted to enrich the application process and learning environment. Yazıcı & Göktentürk (2019) revealed that the story genre should be associated with different materials and used in practical activities.

Regarding the necessity of the course, prospective Turkish teachers emphasize that it contributes to language skills, that it is comprehensive and fun, that the course is productive, and that it is used for therapeutic purposes. Çetinkaya & Sönmez (2019) made a similar emphasis and stated that most of the basic language skills of individuals can be developed through tale telling.
Yazıcı & Göktentürk (2019) see texts as the main element in the development of basic linguistic skills. For this

reason, it is important for prospective teachers to master text types. In this study, Turkish teacher candidates revealed that the story and tale telling course is necessary because it contributes to linguistic skills, its scope, being fun, being productive and being used for therapeutic purposes.

The perceptions of prospective Turkish teachers about the course were categorized under six main themes: professional development, therapy, personal development, cultural relationship, self-evaluation and application. In the literature, there are studies supporting the relationship between culture (Temizyürek & Vargelen, 2016), the therapy aspect (Uç, 2022), and its effect on professional development (Oruç & Çağır, 2020).

RECOMMENDATIONS

In the teaching process of Turkish teacher candidates;

1. By ensuring the use of the story and tale genre in different materials, the development of comprehension and expression skills can be ensured.
2. By including different text types including stories and tales, it can be ensured that prospective teachers have a good command of text types.

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Use of Information and Communication Technologies in Teaching of Science: A Perception and Practices of Science Teachers

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ABSTRACT
Information and Communication Technology (ICT) has become one of the basic building blocks of modern society. This research attempts to highlight the use of ICT by science teachers with respect to their classroom practices, administration, personal use and professional development. The data was collected from 30 science teachers working in schools of Delhi/NCR. To collect the data on the above cited domains a self-made questionnaire was administered. Prior permission and consent was taken to collect the data from the selected subjects. Obtained raw data was first tabulated and then statistically analysed by using descriptive as well as chi square tests. The findings of statistical analysis revealed that browsing internet to collect learning material and to prepare science lessons were practiced by teachers more frequently. Many teachers have undergone either introductory or equipment-specific training, however very few of them have received training in advanced courses on internet use (creating websites, video-conferencing, etc.). As far as perception of science teachers regarding use of ICT in science teachers was considered, findings revealed that most of the teachers were found very optimistic in using ICT while teaching.
Keywords: administration, classroom practices, personal use, professional development, ICT, science teaching

INTRODUCTION

In this digital era, it is hard to ignore the use of Information and Communication Technology (ICT) in our everyday life. Within a very short span of time, ICT has become one of the basic building blocks of modern society. Human beings are surrounded by different media sources such as television, radio, computers etc., from waking up in the morning till they sleep. This reflects how much ICT has infiltrated in our life. In fact many countries have now accepted the fact that understanding ICT along with reading, writing and numeracy, and mastering the basic skills and concepts of ICT are the core part of education.

Here, it is important to know that UNESCO (2002) refers the term ICT as the *"forms of technology that are used to transmit, process, store, create, display, share or exchange information by electronic means. This broad definition of ICT include technologies such as radio, television, video, DVD, satellite systems, computer, network hardware, software, as well as the equipment and services associated with these technologies, such as videoconferencing, electronic mail."*

In National Policy on Information and Communication Technology in School Education (2012), it is mentioned that *"ICT enabled teaching-learning encompasses a variety of techniques, tools, content and resources aimed at improving the quality and efficiency of the teaching-learning process. Ranging from projecting media to support a lesson, to multimedia self-learning modules, to simulations to virtual learning environments, there are a variety of options available to the teacher to utilise various ICT tools for effective pedagogy. Each such device or strategy also involves changes in the classroom environment, and its bearing on effectiveness. Availability of a wide range of such teaching-learning materials will catalyse transformation of classrooms into ICT Enabled classrooms".*

Studies suggested that ICT enabled classrooms have more impact on the students' learning (Osborne & Hennesy, 2003; Wellington, 2003; Hogarth et. al., 2006). In the same line the studies which conducted to analyse the impact of integration of ICT in science education suggests that ICT integration makes learning environment more engaging, pragmatic, relevant, self-directed, reflective as well as it encourages the learners to study topics in a way

that leads to deep and understandable knowledge based on learning objectives (Osborne & Hennesy, 2003). It also boosts motivation, interest and participation in teaching-learning activities (Denby & Campbell, 2005).

ICT in science education can create an environment where students may visualise and manipulate complex models, 3-D visuals for better understanding of scientific concepts and can assist students in focusing on important concerns, making underlying abstract concepts more salient (Denby & Campbell, 2005; Dori & Barak, 2001; Rogers, 2006). ICT also enable users to access high-quality and useful resources (web-pages, documents, videos, simulations etc.) for scientific learning (Osborne & Hennesy, 2003). Furthermore, use of ICT encourages experimentation and inquiry by offering quick visual feedback which can also help students in learning how to use ICT or develop their digital literacy (Newton & Rogers, 2001; Osborne & Hennesy, 2003).

Hogarth et al. (2006) documented that use of ICT simulations by students greatly enhanced their knowledge of scientific concepts as compared to non-ICT activities. With tools like data-logging, blogs and wikis, podcasts, simulation software, YouTube videos and digital microscopes, teachers are now using ICT to make science lessons more engaging and practical (Murphy, 2009). On the contrary, Huang et al. (2021) in their study found a negative relationship between students' ICT use in learning and their science performance and they stated that *"…in order to provide more concrete evidence of the impact of ICT use on students' academic achievement in general, and on students' science performance in particular, a more comprehensive model is needed to investigate multiple influencing factors"*. Also, findings of Hu et al. (2018) revealed that ICT availability for students at school is positively associated with students' academic success, however ICT availability at home was negatively associated with their academic success.

Review of all these studies cleared the fact that, rapid developments in hardware and software paved way for new possibilities. Yet there are considerable gap between the aspirations of the experts and the classroom reality. Researches have been done to analyse the effectiveness of using ICT in science teaching and to what extent it is being used by the school teachers (Osborne & Hennessy, 2003; Newton & Rogers, 2001; Juuti et al., 2009), but country like India needs more researches to be conducted in order to understand the contribution of teachers' role in determining the effectiveness of ICT in science lessons. Thus, this investigation aimed to analyse usage of ICT by science teachers for their classes, administrative purposes, personal use and professional development while teaching science at school.

METHODS AND MATERIALS

In this section, the details of participants of the study, tools and techniques used, procedure and analysis of data collection is mentioned.

Participants

A total of 30 science teachers were recruited from the 10 secondary schools of Delhi/NCR to work on the objective. A multistage random sampling technique was adopted to first select 10 schools then 30 science teachers from those schools.

Tools and Techniques

A questionnaire on "Use of ICT in Science Teaching" was developed to collect data from the selected science teachers. Few items of the developed questionnaire were adopted from the work of Alturki and Ahmad (2014), Almaghlouth (2008) and TQICT. The statements (questions) in the questionnaire was arranged into 4 sections, namely- Classroom practices, Administration, Personal Use and Professional Development having both closed as well as open-ended questions. The questionnaire was validated by a panel of experts working in the field.

Procedure of Data Collection

The data was collected from 10 selected schools situated in Delhi/NCR. To initiate the data collection procedure, a prior permission was obtained from the principals of the respective schools. After obtaining permission, the researcher approached the concerned science teachers and obtained their consent as well for responding on the questionnaire. A brief instruction and purpose of the study was explained to each participant before commencement of data collection, and after that their filled questionnaires were collected back. On an average, the respondents took 8 minutes to fill the questionnaire. Around 2 months were spent to collect the data from 30 science teachers.

Statistical Analysis

Obtained raw data was entered and tabulated into MS Excel sheet for data analysis procedure. After entering data into excel sheet, the data was exported to SPSS-(v.23) and descriptive statistics, percentage analysis and chi square were computed for final interpretation. An Alpha level of 0.05 was set to know the significance difference.

RESULTS

The science teachers were asked to respond on the most appropriate options provided in the questionnaire indicating their use of ICT on the areas: Classroom Practices, Administration, Personal Use and Professional Development. Results of the statistical analysis are presented in the following tables and graphs.

As far as Classroom Practices were concerned, this section included 7 closed-ended questions and 3 open-ended questions. The science teachers' responses on each item are given below in Table 1.1.

Table 1.1: Responses of Science Teachers on their use of ICT with respect to their Classroom Practices

S.No.	Statement	Daily	Weekly	Monthly	Once or twice a year	Never	Chi-square
1	"Browsing or Searching internet to collect information to prepare Science lessons"	7 (23.3%)	12 (40%)	4 (13.3%)	4 (13.3%)	3 (10%)	8.98
2	"Browsing or Searching internet to collect learning material or resources to be used by students during lessons"	9 (30%)	8 (26.7%)	8 (26.7%)	1 (3.3%)	4 (13.3%)	7.64
3	"Using applications to prepare presentations for Science lessons"	4 (13.3%)	9 (30%)	6 (20%)	2 (6.7%)	9 (30%)	6.32
4	"Creating your own digital learning materials for students"	3 (10%)	7 (23.3%)	3 (10%)	6 (20%)	11 (36.7%)	7.32
5	"Posting Science home work for students on the school website/ Learning Management System"	2 (6.7%)	5 (16.7%)	2 (6.7%)	8 (26.7%)	13 (43.3%)	14.3*
6	"Using ICT to provide feedback or assess students' learning of Science concepts"	1 (3.3%)	7 (23.3%)	4 (13.3%)	3 (10%)	15 (50%)	19.9*
7	"Downloading, uploading or browsing materials from Open Educational Resources for Science Teaching and Learning"	5 (16.7%)	7 (23.3%)	4 (13.3%)	5 (16.7%)	9 (30%)	2.64

*Significant at 0.05 level Tabulated $x^2_{0.05}(4)=9.488$

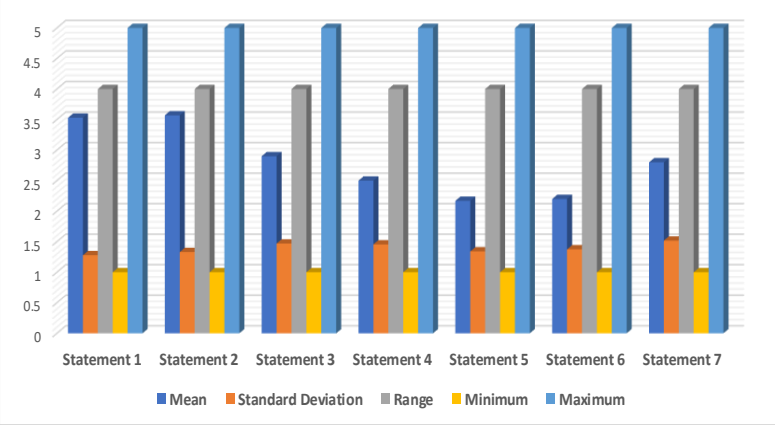

Figure 1.1: Graphical illustration representing responses of science teachers on their use of ICT with respect to their classroom practices

The findings documented in Table 1.1 and Figure 1.1 indicates that, there was no significant difference in expected and observed frequencies for the items 'browsing or searching internet to collect information to prepare science lessons', 'browsing or searching internet to collect learning material or resources to be used by students during lessons', 'using applications to prepare presentations for science lessons', 'creating own digital learning materials for students' and for 'downloading, uploading or browsing materials from Open Educational Resources for science teaching and learning'. Hence it reveals that these activities are practiced by science teachers quite frequently. However, the calculated chi-square value for the items 'posting science homework for students on the school website/LMS (Learning Management System)' and 'using ICT to provide feedback or assess students' learning of science concepts' was more than the tabulated chi-square value which implied that there was a significant difference among the responses of the science teachers on these statements and therefore, it reveals that these activities were least practiced by science teachers.

Further, **three open-ended questions** were also asked to the science teachers about their use of ICT for classroom practices. The **first open-ended question** was related to the perception of teachers about using ICT in Science for better understanding of the concepts. All the thirty teachers agreed that using ICT in science is better for understanding of the concepts. Provided reasons of the science teachers were grouped based on similarity and it is presented in Table 1.2.

Table 1.2: Perception of teachers about using ICT in Science for better understanding of the concepts

S.No.	Statement	Frequency	Percentage (%)
1	Biology: Structure of DNA, RNA, Structure of a cell, Tissues, Cell Division, Genetics, Microorganisms, Digestive System, Respiratory System, Circulatory System, Evolution	17	56.7%
2	Physics: Electromagnet, Electroplating, Sound, Light, Electricity, Magnetic effects of Electric Current	7	23.3%
3	Chemistry: Chemical bonding, Chemical Reaction, Atoms and Molecules	6	20%

Table 1.2 shows that, more than half of the science teachers (53%) reported that ICT in Science leads to better understanding of the concepts as it provides visualization of the different concepts of science. According to 16.7% teachers, ICT in Science helps in making learning effective and efficient. Around 13% of the science teachers believed that whole class can be involved as students enjoy learning through ICT. Whereas, rest of the 16% science teachers indicated that ICT can help average students understand the concept and a lot of study materials can be accessed through ICT that can be used for science teaching and learning.

In the **second open-ended question**, the science teachers were asked to list the topics of science which were best understood only by using ICT. Obtained responses are presented in below Table 1.3.

Table 1.3: Perception of teachers about topics of science best understood only by using ICT

S.No.	Statement	Frequency	Percentage (%)
1	Yes, because it provides visualization of the different concepts of Science	16	53.3 %
2	Yes, it helps the average students understand the topic much better	3	10%
3	Yes, a lot of study materials can be accessed through ICT	2	6.7%
4	Yes, ICT in Science helps in making learning effective and efficient	5	16.7%
5	Yes, whole class can be involved as students enjoy learning through ICT	4	13.3%

Readings of Table 1.3 indicates that, the topics such as Structure of DNA, Structure of a cell, Cell Division, Genetics, Microorganisms, Digestive System, Respiratory System, Circulatory System, Electromagnet, Electroplating, Sound, Light, Magnetic effects of Electric Current, Chemical bonding, Chemical Reaction, Atoms and Molecules etc. are some of the topics that were best understood only by using ICT, as reported by the teachers. Science teachers also reported that, the frequency of topics related with Biology (56.7%) was more as compared to the topics related to Physics (23.3%) and Chemistry (20%).

In the **third open-ended question**, the teachers were asked to give suggestions as how ICT can be used effectively in Science, its results are provided into below mentioned Table 1.4.

Table 1.4: Suggestions given by teachers about effective use of ICT in Science

S.No.	Statement	Frequency	Percentage (%)
1	Different concepts of Science can be taught using Projectors, Laptops & Internet	5	16.7%
2	Creating Presentations, Video Clips, Animations	3	10%
3	ICT can be effectively used for preparing Lesson Plans	4	13.3%
4	Availability and Adequacy of ICT Resources	6	20%
5	By showing them 3D pictures/models and correlating the concept with real life examples	3	10%

6	Providing training in ICT	2	6.7%
7	Authentic data can be accessed through ICT	2	6.7%
8	Quiz and tests can be prepared	3	10%
9	ICT can be used for teachers' self-learning	2	6.7%

According to the readings of Table 1.4, the suggestions given by the teachers indicate that effective use of ICT in Science can only be possible if there are adequate ICT tools available in the schools. Other suggestions by science teachers include, the use of ICT helpful in Lesson Planning, for developing Quiz and Tests for the students, Need for training of ICT for self-learning and authentic data accessibility.

The second major section of the questionnaire was Administration. In this section 7 closed-ended question were included. The teachers' responses regarding each item of this section are given below in the Table 2.1. Frequency, percentage and chi-square value has been calculated for the same.

Table 2.1: Responses of Science Teachers on their use of ICT with respect to Administration

S.No.	Statement	Daily	Weekly	Monthly	Once or twice a year	Never	Chi-square
1	Typing exam papers	0	4 (13.3%)	16 (53.3%)	2 (6.7%)	8 (26.7%)	26.64*
2	Writing student reports	0	6 (20%)	9 (30%)	6 (20%)	9 (30%)	9
3	Recording students' Science grades	0	3 (10%)	12 (40%)	13 (43.3%)	2 (6.7%)	24.32*
4	Recording students' attendance	15 (50%)	4 (13.3%)	5 (16.7%)	3 (10%)	3 (10%)	17.32*
5	Checking school timetable or notices	14 (46.7%)	4 (13.3%)	6 (20%)	1 (3.3%)	5 (16.7%)	15.64*
6	Contacting colleagues via emails	3 (10%)	4 (13.3%)	2 (6.7%)	10 (33.3%)	11 (36.7%)	11.64*
7	Communicating online with parents	2 (6.7%)	2 (6.7%)	3 (10%)	8 (26.7%)	15 (50%)	20.98*

*Significant at 0.05 level Tabulated $x^2_{0.05}(4)=9.488$

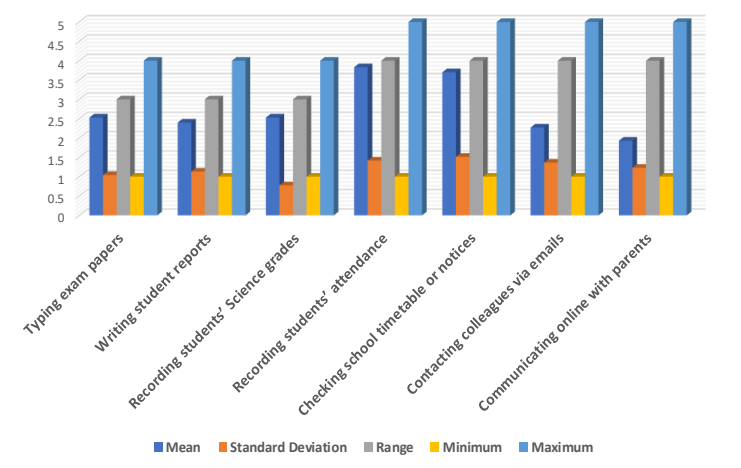

Figure 2.1: Graphical illustration of the responses of science teachers on their use of ICT with respect to administration

According to the findings given in Table 2.1 and illustration provided in Figure 2.1, the science teachers reported that they use ICT quite often for 'recording students' attendance', 'checking school timetable or notices', 'typing exam papers' and 'recording students' Science grades'. Whereas, 'communicating online with parents' and 'contacting colleagues via emails' were less frequent. On calculating the chi-square value for these items it was found that, there was no significant difference among the responses of the science teachers on the item 'writing student reports' whereas there was a significant difference for the rest of the items of this section i.e., Administration.

The third section of the questionnaire was dedicated to Personal Use. This section of using ICT for Personal use included 7 closed-ended questions. The science teachers' responses regarding each item are given below in the Table 3.1.

Table 3.1: Responses of Science Teachers on their use of ICT with respect to Personal Use

S.No.	Statement	Daily	Weekly	Monthly	Once or twice a year	Never	Chi-square
1	WhatsApp	30 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	120*
2	Facebook	12 (40%)	9 (30%)	2 (6.7%)	1 (3.3%)	6 (20%)	14.32*
3	Instagram	9 (30%)	2 (6.7%)	3 (10%)	0 (0%)	16 (53.3%)	28.32*
4	Twitter	6 (20%)	2 (6.7%)	2 (6.7%)	0 (0%)	20 (66.7%)	43.98*
5	YouTube	24 (80%)	4 (13.3%)	2 (6.7%)	0 (0%)	0 (0%)	69.32*
6	Google	22 (73.3%)	3 (10%)	1 (3.3%)	0 (0%)	4 (13.3%)	54.92*

*Significant at 0.05 level Tabulated $x^2_{0.05}(4)=9.488$

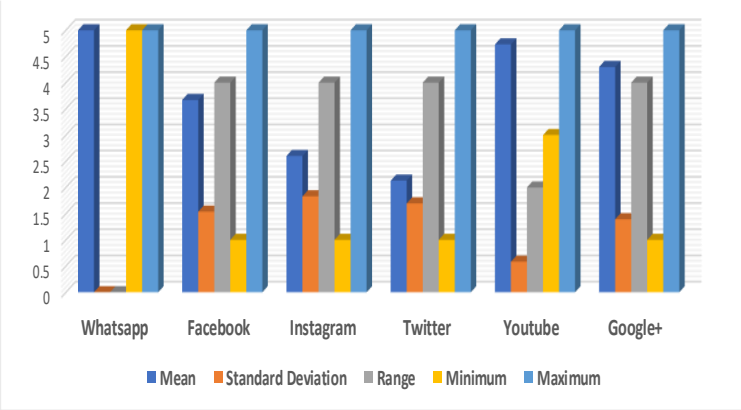

Figure 3.1: Graphical illustration of the responses of science teachers on their use of ICT with respect to personal use

Table 3.1 and Figure 3.1 reveals that there was a significant difference among the responses of the science teachers on all the items of this section and it was quite evident that use of WhatsApp (100%) and YouTube (80%) daily by the teachers was most frequent. Next to that is Google, which was used by 73.3% of the teachers on a daily basis and Facebook (40%). Twitter (42%) was found least used by the science teachers among other options provided in the list.

Last section of the questionnaire contain questions related to Professional Development. This section included 9 closed-ended questions. Science teachers were asked to indicate if they have undergone any professional development training (in-service training) in the last two years of school. The teachers' responses regarding each item of this section of the questionnaire are indicated in the Table 4.1 and Figure 4.1 in percentage.

Table 4.1: Responses of Science Teachers on their use of ICT with respect to Professional Development

S.No.	Statement	Yes	No	Chi-square
1	"Introductory courses on internet use and general applications (basic word-processing, spreadsheets, presentations, databases, etc.)"	17 (56.7%)	13 (43.3%)	0.52
2	"Advanced courses on applications (advanced word-processing, complex relational databases, Virtual Learning Environment etc.)"	10 (33.3%)	20 (66.7%)	3.32
3	"Advanced courses on internet use (creating websites/home page, video conferencing, etc.)"	6 (20%)	24 (80%)	10.8*
4	"Equipment-specific training (interactive whiteboard, laptop, etc.)"	13 (43.3%)	17 (56.7%)	0.52
5	"Courses on the pedagogical use of ICT in teaching and learning"	11 (36.7%)	19 (63.3%)	2.12
6	"Subject-specific training on learning applications (tutorials, simulations, etc.)"	15 (50%)	15 (50%)	0
7	"Course on multimedia (using digital video, audio equipment, etc.)"	11 (36.7%)	19 (63.3%)	2.12
8	"Participate in online communities (e.g. mailing lists, twitter, blogs) for professional discussions with other teachers"	11 (36.7%)	19 (63.3%)	2.12

9	"Other professional development opportunities related to ICT"	7 (23.3%)	23 (76.7%)	8.52*

*Significant at 0.05 level Tabulated $x^2_{0.05}(1)=3.841$

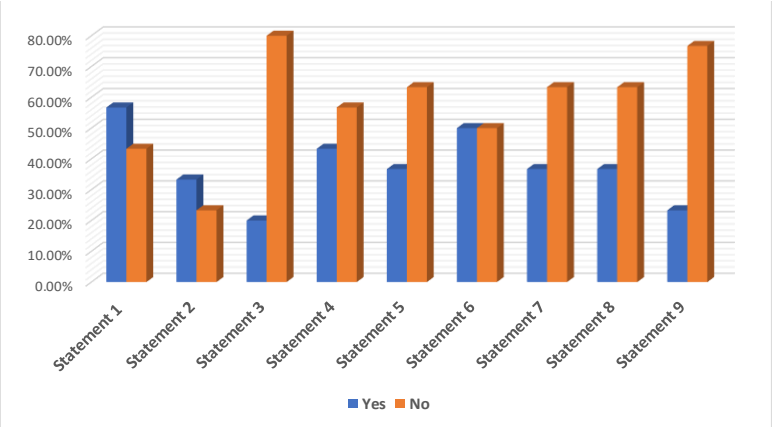

Figure 4.1: Graphical illustration of the responses of science teachers on their use of ICT with respect to professional development

The findings related to the fourth section of the questionnaire is presented in Table 4.1 and Figure 4.1, and it shows that 56.7% of the science teachers have undergone training in "introductory courses on internet use and general applications (basic word-processing, spreadsheets, presentations, databases, etc.)", half of them (50%) in "subject-specific training on learning applications (tutorials, simulations, etc.)" and 43.3% in "Equipment-specific training (interactive whiteboard, laptop, etc.)". Whereas, only 20% teachers have undergone "training in advanced courses on internet use (creating websites/home page, video conferencing, etc.)". There was a significant difference among the responses of science teachers on the items "Advanced courses on internet use (creating websites/home page, video conferencing, etc.)" and "Other professional development opportunities related to ICT" however, there was no significant difference for the rest of the statements.

DISCUSSION

This study was undertaken to analyse the use of ICT by science teachers in their classroom practices, administration, personal use and professional development. Findings related with classroom practices revealed that majority of the respondents browse internet to collect information to prepare science lessons and to search learning material or resources to be used by students during lessons either daily or weekly. Levonen (2008) throws light on benefits of using Learning Management System (LMS) and states that distance learning approaches which includes lecture notes, homework projects, online books and complete courses in science, physics, chemistry or biology are available on the Web. The whole course can be managed by the Science Teacher through a Learning Management Systems (LMS). However, it was also found that not many of the respondents of this study uses LMS or other tools to post homework or learning materials.

The science teachers revealed that use of ICT in science leads to better understanding of the concepts as it provides visualization of different concepts of science. The findings are consistent with Rogers (2006). Other benefits, as reported by them, includes ICT making learning effective and increases students' engagement as they enjoy learning through ICT. They also believe that ICT can help average students understand the concept and a lot of study materials can be accessed through ICT that can be used for science teaching and learning. The findings are consistent with Osborne and Hennessy (2003) which suggests that ICT in teaching and learning increases interest, motivation and engagement in activities, provide access to a number of resources that are of high quality and relevant to scientific learning.

The science teachers also reported that ICT resources were used to teach Biology concepts more as compared to Physics and Chemistry. This might be due to the fact that the visual representations help in better understanding of the concepts (Dori & Barak (2001); Rogers, 2006). When teachers were asked about suggestions for effective use of ICT in science, many of them indicated that availability and adequacy of ICT resources are important in this regard. Also, different concepts of science can be taught by showing students 3D pictures/models and correlating the concept with real life examples. Furthermore, the teachers also reported that ICT can be effectively used for preparing lesson plans and for preparing quiz and tests for assessment and therefore, providing training in ICT would be highly beneficial. The findings are consistent with Tondeur et al. (2007), which says that supportive ICT use includes preparing lesson plan, worksheets and developing evaluation activities.

As far as ICT use for administrative purposes by science teachers were concerned, it was found that teachers used ICT tools quite frequently for recording students' attendance and for checking school timetable or notices. The findings are in line with Newton and Rogers (2003) which highlights the importance of using ICT by teachers as it is good for handling data and it is also time saving. On the contrary, it was found that many of the respondents do not use ICT tools much to communicate online with parents or for contacting colleagues via emails. For personal use, WhatsApp, YouTube and Google are the most frequently used applications, as indicated by the respondents. Through WhatsApp groups they coordinate with students as well as their colleagues. Often learning materials or even notices were shared through such platforms. Google and YouTube were frequently used by them to search learning materials that can be used for making lesson plans as well as for sharing additional resources to students for extended learning. The findings are consistent with Berk (2009) and Seilstad (2012) which examined the role of YouTube videos for teaching students.

The science teachers were asked to indicate if they have undergone any professional development training in the past two years in school. Findings revealed that more than half of the respondents have undergone training in introductory courses on internet use and general applications. However, only a few of them have undergone training in advanced courses such as creating websites/homepage or conducting video conferencing. Some of them indicated that they have received training for understanding how to use interactive whiteboard, virtual learning environment, use of multimedia in teaching-learning process etc. In addition, some teachers also reported that they have received subject-specific training on learning applications such as simulations. It is observed that due to lack of training, teachers feel hesitant in integrating ICT in their lessons and for using it for various purposes that would be beneficial for them (Becta, 2004). The reasons for not undergoing any training can be either their resistance to change (Habibu et al., 2012; Juuti et. al., 2009) or due to time constraints (Becta, 2004; Juuti et. al., 2009) . ICT is not used by teachers to such extent as it could be appropriate according to the potentials reported in the literature because sometimes the teachers have insufficient time to learn about the use of ICT and its applications in classrooms and they have no confidence in using ICT (Juuti et. al., 2009). However, it is important for teachers to undergo training so that they can use ICT along with their professional skills during lesson to maximise its potential.

CONCLUSION

It is believed that students' grasp and retention of scientific knowledge improves when science concepts are taught through ICT. This research was an attempt to understand the perception and practices of science teachers towards using ICT for classroom practices, administration, personal use and for their professional development. Within the limits and limitations, it can be concluded that when compared to traditional ways, incorporating ICT in science lessons can help science teachers in lesson preparation, in managing students' data (marks, attendance etc), in communicating with students and sharing learning resources with them. Furthermore, it has the potential to make the teaching-learning process more engaging and motivating which may lead to achieving better learning outcomes. In order to enhance their knowledge and skills, science teachers can use various software and they can keep themselves updated with the technological advancements in their field (specialization).

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