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The Relationship between Educators' Attitudes, Perceived Usefulness, and Perceived Ease of Use of Instructional and Web-Based Technologies: Implications from Technology Acceptance Model (TAM)

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Abstract

Over the years, developing countries have experienced tremendous growth in access to information and communication technology (ICT). This growth in access to ICT has brought about massive changes in many sectors within the society, including education. Researchers explored teacher educators' attitudes and use of instructional and web-based technologies in teacher preparation programs. Researchers used Technology Acceptance Model (TAM) in this study. Using a mixed-method design, researchers examined the relationships between educators' attitudes and the use of technology. Findings from descriptive statistics have shown that educators exhibited overall positive attitudes toward technology. Pearson's product-moment correlation coefficient revealed relationship exists between perceived ease of use and perceived usefulness. Both quantitative and qualitative findings in this study have implications for educators and administrators in Nigerian education, especially, teacher preparation programs.

Introduction

Globally, there is a rapid growth in access to information and communications technology, developing countries are not excluded. Over the years, developing countries have experienced tremendous growth in access to information and communications technology (Ibrahim, 2019). This growth in access to information and communications technology has brought about massive changes in many sectors within society. For example, in Nigeria, the government (Federal, State, and Local) and stakeholders in education have devised means to revamp the country's education with technology access at all levels (Garba & Alademerin, 2014). Nigeria, like many other developing countries, is faced with challenges regarding the integration of instructional and web-based technologies in teaching (Ibrahim, 2019). There is an absence of enormous empirical literature that explores teacher educators' attitudes and use of instructional and web-based technologies for teaching in the country's teacher preparation programs. The focus of this paper is to provide insight into the relationship between Nigerian teacher educators' attitudes, perceived usefulness, and perceived ease of use of instructional and web-based technologies.

The paper begins with a review of related literature and the theoretical framework that guides the conduct of this

research. Following this, a description of the problem and purpose of the study are provided. The paper also describes the methodology employed in this study. Finally, researchers discuss the quantitative and qualitative findings as they relate to the implications for educators, administrators, and stakeholders in Nigeria's education, specifically, teacher preparation programs.

Literature Review and Theoretical Framework

The generation of students in the twenty-first-century classrooms prompted education systems around the world to embrace technology as a tool for instruction. Prensky (2006) elucidates that the education of children born in the digital age is considerably affected by the changes brought about by the information age. The U.S. Department of Education (2004) reviewed and updated the National Education Technology Plan (NETP) of 1999.
In this review, the United States Department of Education (2004) acknowledged the changes brought about by technology,

> We have reached a turning point. All over this country, we see evidence of new excitement in education, a new determination, a hunger for change. The technology that has so dramatically changed the world outside our school is now changing the learning and teaching within them. (p. 6)

Since 2004, technology has been widely accepted and utilized for teaching and learning from PreK through 20 (U.S. Department of Education, 2004).

Technology attitude dictates educators' acceptance and use of technology. Dugger (2001) opines that "it is particularly important in this technological world that people understand and are comfortable with the concepts and working with modern technology" (p. 1). Upon this, educators and students develop a technology attitude. We often hear this phrase about technology attitude, "I have a positive attitude about technology." However, we seldom dig deep into the meaning of this phrase. Talking about an attitude toward an object, we are engaged in describing the evaluative interpretation of being positive or negative toward that object (Sevilla et al., 2006). Sevilla et al. (2006) clarify that,

> When we speak of a positive or negative attitude toward an object, we are referring to the evaluative component. Evaluations are a function of cognitive, affective, and behavioral intentions of the object. Evaluation is stored in memory often, without the corresponding cognitions and effects that were responsible for its formation. (p. 358)

Van-Giesen et al. (2015), expressed that attitude results from preceding experience on knowledge and functions which shape an individual's attitude formation. Around the world, scholars have written extensively about educators' technology attitudes formation (Hart & Laher, 2015; Liu, 2016; Pittman & Gains, 2015; Varol 2012). Literature has shown that there is a strong relationship between educators' technology attitudes and use for teaching. Buabben-Andoh (2012) reports that "attitudes of teachers towards technology greatly influence their adoption and integration of computers into teacher" (p. 138). Research has shown that Nigerian educators who exhibit positive attitudes towards technology tend to use it for teaching (Aremu & Adediran, 2011; Kenechukwu & Oboko, 2013; Onwuagboke & Singh, 2016). Specifically, Onwuagboke and Singh (2016) studied educators' attitudes toward the use of Information and Communication Technology (ICT) in southwestern Nigeria. Findings

revealed that educators' acceptance and use of ICT in instructional delivery is strongly correlated with their attitudes toward technology integration, which results from their perceived benefits of integrating technology for instruction.

Educators' negative attitudes toward technology may affect their level of technology integration. Ajoku (2014) found that educators' negative attitudes toward technology have a tremendous impact on the use of technology for teaching. Oke (2013) suggests that there is a critical need to address educators' negative attitudes towards technology especially since technology is revolutionizing the way we teach and learn at a rapid speed. Despite educators' positive attitudes towards technology, instructional and web-based technologies are underutilized by educators. This study aimed at examining Nigerian teacher educators' attitudes, perceived usefulness, and perceived ease of use of both instructional and web-based technology for teaching. At this point, it is imperative to discuss the theoretical framework for this study.

Theoretical Framework: Technology Acceptance Model (TAM)

Davis et al. (1989) developed the Technology Acceptance Model from Fishbein and Ajzens' Theory of Reasoned Action (TRA). TAM has gained popularity in terms of usage as it depicts the interaction of various components regarding attitude formation and technology use. These components include external variables, perceived usefulness (PU), perceived ease of use (PEU), attitude toward (A), behavioral intention to use (A), and actual system use. For this study, the external variables are technology tools available for educators to use, and A stands for a particular technology for a specific purpose in the classroom (example, an assessment technology). TAM put a great emphasis on perceived ease of use (PEU) and perceived usefulness (PU) of technology which influences an individual's attitude formation toward acceptance or rejection of technology (Davis et al., 1989). Figure 1 shows the various elements of the TAM as identified and explained by Davis et al. (1989).

Chen et al. (2011) posit that TAM provides a conceptual framework for predicting facilitating conditions on the acceptance and integration of technology. Several researchers have used TAM as a theoretical framework to describe factors that influence the acceptance of information systems. For example, Holden and Karsh (2010) mention that TAM would enable the prediction of factors that influence one's attitude toward the acceptance of technology. Thus, it enables administrators to utilize educators' potential by promoting acceptance and increasing technology utilization for teaching and learning purposes. Fathema et al. (2015) explored faculty use of Learning Management System (LMS). Researchers found that TAM had a statistically significant predictive value in terms of educators' attitudes toward using LMSs to deliver course materials. Also, Alharbi and Drew (2014) explored educators' behavioral intentions to use LMSs. They found that there was a strong relationship between educators' attitude to technology, perceived ease of use, and perceived usefulness of LMS which later influences their intention to utilize them for teaching and learning. Conclusively, Echeng et al. (2013) used TAM to explore students' acceptance and use of web 2.0 for learning in some selected in Nigeria. Results from this study revealed a strong correlation between students' attitude, usefulness, and ease of use of web 2.0 with behavioral intention and actual use of web 2.0 technologies for educational purposes. Echeng et al. (2013) suggest that TAM was reliable in predicting attitudes and behavioral intention to adopt a system (technology).

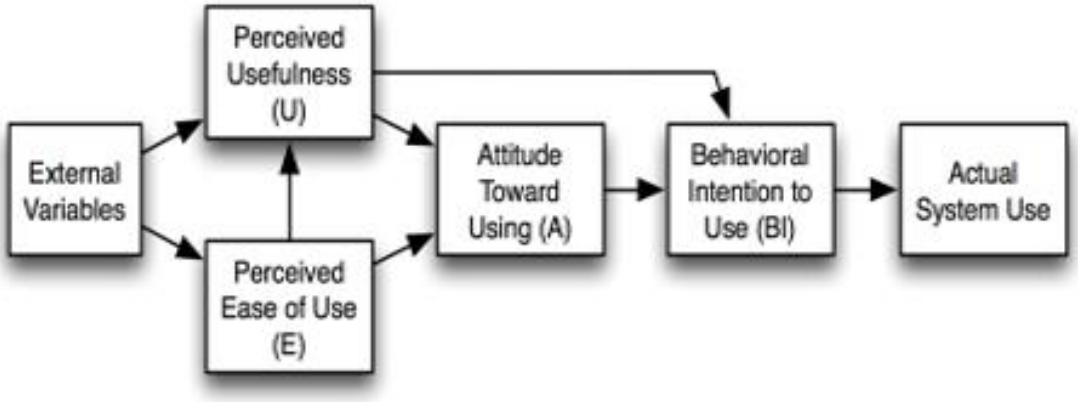

Figure 1. Technology Acceptance Model. First Modified Version Adapted from "User Acceptance of Computer Technology: A Comparison of Two Theoretical Models," by F. Davis, R. P. Bagozzi, and P. R. Warshaw, 1989, Management Science, 35(8), p. 985.

In this study, researchers adopted TAM as the theoretical framework because of its relevance and it served as a useful framework that will help to unravel the relationships between educators' attitudes, perceived usefulness, and perceived ease of use of instructional and web-based technologies.

Problem, Purpose, and Research Questions

Technology integration in Nigerian teacher preparation programs is in its infancy (Garba et al., 2013). Ibrahim (2019) explains that Nigerian teacher educators are unaware of the various ways that technology can be utilized to enhance instruction. This is partly because, many Nigerian teacher educators lack technology integration skills (Garba et al., 2013; Ibrahim, 2019), and or educators were trained in traditional didactic settings when technology integration was not in any way part of their training as a result of digital divide existing between developed and developing countries (Ibrahim, 2019). The purpose of this study is to use Davis et al. (1989) Technology Acceptance Model (TAM) and examine Nigerian teacher educators' attitudes and use of instructional and web-based technologies in teacher preparation programs. This study was designed to answer the following research questions:

1. What are educators' attitudes toward the use of technology for teaching?
    a. What are educators' attitudes toward the use of instructional technology for teaching?
    b. What are educators' attitudes toward the use of web-based technologies for teaching?
2. What are educators' perceived usefulness and perceived ease of use technology for teaching?
3. Is there a statistically significant relationship between educators' attitudes toward instructional and web-based technologies, perceived usefulness, and perceived ease of use?

Method

The researchers employed a mixed-method research approach emphasizing explanatory sequential design (Creswell, 2012). In this section, researchers describe the population and sample, instrumentation, and procedures used for data collection.

Population and Sample

This study was conducted in five federal colleges of education located within seven states in Nigeria's northwest geopolitical zones. The population involves all teacher educators in these five colleges, namely: Federal College of Education, A; Federal College of Education, B; Federal College of Education, C; Federal College of Education-Technical, D; and Federal College of Education, E). Letters A, B, C, D, and E are used to conceal the names of the institutions. Within these colleges, there are a total of 2099 teacher educators. Researchers adopted a proportionate sampling technique for quantitative samples and a volunteer sampling for qualitative samples (Creswell, 2012).

Data Collection Procedure

Researchers used a self-developed survey and semi-structured interview protocol. Both instruments went through several revisions and finally underwent reliability and validity testing. For the survey, researchers conducted content and face validity testing, and later on reliability testing using Cronbach's alpha (Heale & Twycross, 2015). The Cronbach's alpha value for attitude scale ($\alpha = .80$) and perceived usefulness and perceived ease of use of instructional and web-based technologies scale ($\alpha = .71$) are within the acceptable range for internal consistency (Tavakol & Dennick, 2011). The interview protocol undergoes validity testing by faculty with varying degrees of technology expertise. Their independent feedback was incorporated and guided researchers to come up with the final version of the protocol that was used for the collection of qualitative data. Researchers sent email invitations for participation through administrators in five colleges. The administrators distributed the survey invitation to 100 educators randomly selected from their college's faculty list-serve. Except for the Federal College of Education, E, the administrators sent 200 email invitations because it is larger than the other four colleges. The survey was developed on Qualtrics.

Results

Of the 600-sampled faculty across five colleges, 234 (71.5%) responded. Researchers conducted data clean-up and came up with 190 (58/1%) survey responses that were completed and considered for data analysis. A response rate of 58.1% (190) of the target sample of 327 was deemed pertinent. The researchers exported the survey data generated from Qualtrics to the Statistical Software for the Social Sciences (SPSS). In the survey, an item was created for participants to indicate their willingness to voluntarily participate in a semi-structured interview. Twenty participants indicated their interests, and researchers created a pool of ten participants, two from each college. This, therefore, sums up to ten interviewees for qualitative data. Qualitative data were analyzed using NVivo software.

In this section, researchers discuss the statistical procedures that were used to analyzed data streams (quantitative and qualitative). Quantitative data was first analyzed, followed by the analysis of qualitative data. Results were organized following the sequence of research questions, and the qualitative results are presented to explain the quantitative findings.

Educators' attitudes toward the use of instructional technology for teaching. Research question 1 was designed to investigate teacher educators' attitudes toward the use of instructional and web-based technologies for teaching. Survey items three and seven explored educators' attitudes toward the use of instructional and web-based technologies for teaching.

Findings revealed that there was no significant difference regarding educators' attitudes toward the use of instructional and web-based technologies. Survey item three explored educators' attitudes toward the use of instructional technologies for teaching in Nigerian teacher preparation programs. Table 1 shows the summary of results obtained for this item.

Table 1. Educators' Attitudes toward the Use of Instructional Technology

Attitude	Strongly disagreed n (%)	Disagree n (%)	Somewhat disagree n (%)	Neither agree nor disagree n (%)	Somewhat agree n (%)	Agree n (%)	Strongly Agree n (%)
Instructional Technologies							
Good	103 (54.2)	69 (36.0)	--	--	--	2 (1.1)	16 (8.4)
Unimportant	96 (50.5)	93 (48.9)	--	--	--	--	1 (.5)
Hard	58 (30.5)	130 (68.4)	--	--	--	1 (.5)	1 (.5)
Engaging	--	2 (1.1)	--	155 (81.6)	--	22 (11.6)	11 (5.8)
Inefficient	184 (96.8)	4 (2.1)	--	--	--	1 (.5)	1 (.5)
Useless	20 (10.5)	170 (89.5)	--	--	--	--	--

Table 1 shows that while the majority of educators disagree/strongly disagree that the use of instructional technology for teaching is good (n = 172, 90.2%), only a few agree/strongly agree that the use of instructional technology is good (n = 18, 9.5%). The majority of educators strongly disagree/disagree that the use of instructional technology is unimportant (n = 189, 99.4%). A large number of educators were neutral about their position on the engaging nature of instructional technology (n = 155, 81.6%).

Educators' attitudes toward the use of web-based technologies for teaching. Survey item seven explored educators' attitudes toward the use of web-based technologies for teaching in Nigerian teacher preparation programs. Table 2 presents the results which show that there was a little difference in educators' use of web-based technologies for teaching when compared to the use of instructional technology.

Table 2 shows that the majority of educators agree/strongly agree that the use of web-based technologies for teaching is good (n = 187, 98.4%), only one educator indicated that the use of web-based technologies is not good. The majority of educators strongly disagree/disagree that the use of web-based technologies is unimportant (n = 188, 99.1%). Many educators (n = 169, 88.9%) were neutral regarding their position on whether web-based technologies are engaging.

Table 2. Educators' Attitudes toward the Use of Web-Based Technologies

Attitude	Strongly disagreed n (%)	Disagree n (%)	Somewhat disagree n (%)	Neither agree nor disagree n (%)	Somewhat agree n (%)	Agree n (%)	Strongly Agree n (%)
Web-Based Technologies							
Good	1 (.5)	--	--	--	--	170 (89.5)	17 (8.9)
Unimportant	22 (11.6)	166 (87.5)	--	--	--	--	1 (.5)
Hard	10 (5.3)	10 (5.3)	--	3 (1.6)	--	128 (67.4)	37 (5.8)
Engaging	--	--	--	169 (88.9)	--	9 (4.7)	11 (5.8)
Inefficient	183 (96.3)	5 (2.6)	--	--	--	--	--
Useless	184 (96.8)	5 (2.6)	--	--	--	--	--

Qualitative data generated from the interview protocol corresponding to research question one indicates that educators have a very high positive attitude towards the use of technology for teaching. However, they are more inclined to use web-based technologies for teaching. For this item, researchers develop the following code from a generic coding method: Administrators' positive attitudes to technology, Administrators' negative attitudes to technology, Faculty's positive attitudes to technology, and Faculty's negative attitudes to technology. From these codes, researchers generated 23 meaning units, with varying degrees of the number of mentions (frequency) for each code. Overall findings from this item have shown that the majority of educators interviewed have positive attitudes toward technology in general (n = 9). For example, an interviewee mentioned that,

> I have a very positive attitude towards technology. I go to the extra length to learn more ways of integrating technologies for teaching. I learned about technologies that we don't even have available in our college. And also encourage my colleagues to learn as well. (Interviewee 10).

Item 2b of the interview protocol explored educators' comfort level regarding the use of instructional and web-based technologies. Findings have shown that while half of the educators interviewed expressed that they are very comfortable using both instructional and web-based technologies for teaching (n = 5), and four (n =4) were comfortable; only one (n = 1) educator indicated a lack of comfort using technology for teaching. This interviewee said, "Something that you may not have access to, you may not be comfortable with" (Interviewee 6).

Interviewee 3 explained that" I have a very positive attitude towards technology. There are certain things that you will likely get from technology use, which ordinarily you cannot get. I am very positive about using technology and I am enjoying it." Overall, educators indicated that they are ready, passionate, and always willing to learn how to use technology for teaching despite little support from administrators. Only one interviewee commented on the faculty's negative attitudes. He said, "They (faculty) don't want to because it requires a lot of preparation to be able to use, teach using technologies" (Interviewee 1).

A follow-up question was asked during the interview to all the participants regarding administrators' attitudes toward technology. The majority of educators interviewed indicated that administrators show negative attitudes toward technology use across all the colleges. They based their judgment on administrators' lack of commitment to provide access to the technology required in schools, there was not enough support and encouragement especially since there was not enough technology professional development for educators. Some interviewees pointed out that "Lecturers have positive attitudes, but administrators have negative attitudes. They just provide some of these technologies, and they don't care" (Interviewee 9). Likewise, another interviewee explained,

> Administrators do not even provide us with technical support. Even if you write or forward a request, they hardly get back to you. Their words are always; school is running out of budget. But they will make a provision for it when forwarding another budget. This is where politics come in. I better not go into this. (Interviewee 1)

Of the ten educators interviewed (two from each college) only one pointed to administrators' positive attitudes to technology as positive. The interviewee discussed, "There is a lot of improvement in this regard [technology integration]. Administrators [in my school] are doing a little better [now] due to government dedication and plan to equip our education sector with technology" (Interviewee 5).

Educators' perceived usefulness and perceived ease of use technology for teaching. Research question 2 explored the overall educators' perceived usefulness and perceived ease of use technology from the viewpoint of the Technology Acceptance Model (TAM). Exploring educators' perceived usefulness and perceived ease of use of technology is very necessary for this study because educators' understanding of the perceived usefulness and perceived ease of use of any technology will define their attitudes toward accepting or rejecting that technology. Findings have shown that educators expressed positive attitudes toward their perceived usefulness of technology for teaching. Table 3 presents the mean and standard deviation distribution for this item.

Table 3. Faculty Perceived Usefulness of Technology

Statement	M	SD
It is useful to my students	4.69	.473
It enhances my ability to deliver content effectively	4.20	.411
It improves students' computer skills	4.15	.475
It improves students' ability to engage in research	4.11	.471
It improves students' ability to develop their collaboration skills	4.05	.337
It improves my productivity and efficiency in general	4.01	.424
It enables me to model student-centered strategies	3.38	.631

Table 3 shows that while scores clustered around the mean for a vast majority of items, there was variability in terms of educators' response to the item "It enables me to model student-centered strategies." This item had the lowest mean score and highest standard deviation (M = 3.38, SD = .631). A high sense of neutrality was observed on this item, "it is useful to my students," (M = 4.69, SD = .473).

Similarly, educators expressed positive attitudes toward perceived ease of use of technology. Findings have shown high mean scores for six items under this category, except for the item "It requires few steps possible to accomplish what I want to do with it in my teaching" (M = 4.02, SD = .358). Table 4 presents the result obtained for this item.

Table 4. Faculty Perceived Ease of Use of Technology

Statement	M	SD
I can recover from my mistakes quickly	4.77	.522
It is user-friendly	4.74	.547
I can use it successfully every time	4.18	.505
It is easy/simple to use	4.10	.541
I have the skills and competency to use it	4.06	.352
It is easy for my students to use	4.02	.358
It requires the fewest steps possible to accomplish what I want to do with it in my teaching	3.31	.522

Item 2c of the interview protocol explored educators' technology experience. From responses obtained, a total of nine meaning units were generated from two codes created: Positive Experience and Negative Experience. Findings have shown that the majority of faculty (n = 6) expressed positive experience with technology. For example, one interviewee said, "I have had many positive experiences. My students comment that they like and enjoy what and how I am experimenting and pushing them to learn and use technology" (Interviewee 5). Another interviewee said,

> I am using technology to teach and give assignments to my students. I give them assignments to be submitted online. I have web pages and blogs that I get my grading scale for grading my students. It is a very good experience. I also create a class page where I post grades on Google Documents, share documents. I love it. (Interviewee 9)

Subsequently, three (n = 3) educators explained having negative experiences with technology. For example, one interviewee said,

> Some of my students don't have access to these technologies. They don't even have a good cell phone that they can use to access the internet. This made me get bored sometimes. Also, I do double work. Teach students how to learn and use these technologies and teach content at the same time. (Interviewee 1)

Similarly, interviewee 5 explains "Sometimes I feel, I am doing more than required because you don't have positive support from administrators."

A follow-up open-question was asked that relates to educators' negative experience in using technology for teaching- what are the barriers that prevent you from using technology for teaching? From this item, researchers obtained a total of forty-eight meaning units related to educators' barriers to technology integration from five codes created (lack of technology competence, lack of access to technology, overcrowded classrooms, lack of stable electricity, and poor internet connectivity). Researchers used a generic coding method to analyze data generated and categorized it into two broad categories as institutional-based barriers and faculty-based barriers.

Table 5 presents barriers identified by educators interviewed and the number of times each barrier is mentioned by educators interviewed.

Table 5. Barriers to Educators' Use of Technology for Teaching

Categories	Barriers	Reference by Sources	f
1. Institutional Based	Lack of stable electricity/power supply	9	20
	Lack of access to technology	8	12
	Poor Internet connectivity	5	7
	Overcrowded classrooms	4	4
2. Faculty-Based	Lack of technology competence	3	5

As evident from Table 5, almost all interviewees (n = 9, f = 20) indicated that the "lack of stable electric/power supply" was a major barrier to their technology use. For example, one interviewee said, "the big issue is electricity is not available at any time. So even if you plan to use any technology, this issue will cripple your efforts. You know our problem with electricity, it is still there" (Interviewee 9). Other interviewees expressed similar concerns by indicating that "it made the use of web-based technologies more difficult" (Interviewee 2). Likewise, another interviewee pointed out that "the problem was one in Nigerian schools in general – lack of stable electricity" and explained that attempts are being made to change this. An interviewee said, "some of our new lecture halls, actually they are equipped with a standby generator as an alternative power supply" (Interviewee 8).

Data generated helped to explain why lack of or inadequate access is a key barrier to educators' use of technology for teaching. Eight of the ten interviewees made 12 comments related to "lack of access to technology." They explained that technology access to technology varies across colleges and that there is inadequate access to instructional and web-based technologies needed to facilitate instruction. For example, one interviewee said, "Absence of most of the tools. I mean technologies. We don't have enough access to the majority of technologies" (Interviewee 6).

Poor internet connectivity is another barrier that was identified by five interviewees. In five comments, some interviewees described the depth of the problem. One interviewee explained, "We also have internet connection in the IT centers and library, here it is a strong connection. But around the college, in the classroom areas, we have it, but it is very weak or too poor" (Interviewee 2). However, Interviewee 4 said, "We don't have a reliable Internet connection."

Educators highlighted students' overpopulation as one of the barriers that prevent them from using technology for teaching. Four educators interviewed made four comments about how this high number impeded their efforts to integrate technology into teaching. For example, one educator explained,

> Sometimes also, the student population is an obstacle. We have classes that have over 300 students, for example, everyone in the School of Education knows this, also in the School of Languages. So, with this large number of students, this is a big obstacle. (Interviewee 8)

Educators have developed some strategies to address the problem of overcrowded classrooms. One educator said, “Roughly we have about 250 or more students in a class. So, you have to divide them into sections to be able to teach. Too much work on lecturer’s side” (Interview 2). Nevertheless, the large number of students in the classroom remains a barrier to educators' use of technology for teaching.

Technology competency plays an important role in determining educators' use of technology for teaching. Three educators made five comments about, “lack of technology competence” as a barrier to technology utilization. They explained that a lack of technology competence had prevented them from utilizing instructional and web-based technologies for teaching. One educator said, “Knowledge (competence) is another factor that prevents the use of technology. It is not everyone who is good at it” (Interviewee 2). Another educator elaborates on his colleagues’ competence by saying, “I will tell you not all lecturers are using technology because they do not have knowledge. They don’t have the competence that is required” (Interviewee 5).

Relationship between educators’ attitudes toward instructional and web-based technologies, perceived usefulness, and perceived ease of use of technology. Research question 3 explored the relationship between educators' attitude, perceived ease usefulness, perceived ease of use, and technology used for teaching. Survey items three and seven explored educators' attitudes toward instructional and web-based technologies, and survey items 11 and 12 examined educators' perceived usefulness and perceived ease of use of technology. Data were collected using a five-point Likert scale (strongly disagree, disagree, neither agree nor disagree, agree and strongly agree). To analyze these items, researchers computed and created scales for educators' technology attitudes, perceived usefulness, and perceived ease of use. Survey items three and four were merged to create an instructional technology attitudes scale (Inst_Att_Scale), and survey items seven and eight to create a web-based technology attitudes scale (Web_Att_Scale). Researchers conducted similar procedures described above and created scales for educators' perceived usefulness of technology (PU_Scale) and perceived ease of use (PEU_Scale).

To examine the relationship between educators' attitudes, perceived usefulness, and perceived ease of use and technology use and answer research question 3, researchers ran Pearson’s product-moment correlation coefficient. Table 6 presents means, standards deviations, and correlations for educators' attitudes toward instructional and web-based technologies, perceived usefulness, and perceived ease of use.

Table 6. Correlations for Educators’ Attitudes, PU, and PEU of Technologies

Variables		M	SD	1	2	3	4
1	Inst_Att_Scale	11.14	1.86	1.0	-.207**	-.175*	-.008
2	Web_Att_Scale	15.10	.630		1.0	.204**	.002
3	PEU_Scale	29.2	1.75			1.0	.624**
4	PU_Scale	28.6	1.77				1.0

**. $p < .01$ two-tailed. * $p < .05$ two-tailed

Table 6 shows that there was a strong positive correlation between educators’ perceived ease of use of technology and perceived usefulness ($r = .624$, $n = 185$, $p < .01$). Moreover, there was a small positive correlation between

educators' perceived ease of use and attitudes toward web-based technologies ($r = .204$, $n = 184$, $p < .05$). There was a small negative correlation between survey respondents' attitudes toward instructional and web-based technologies ($r = -.207$, $n = 186$, $p < .01$). Likewise, there was a small negative correlation between survey respondents' perceived ease of use and attitude towards instructional technology ($r = -.175$, $n = 188$, $p < .01$).

Discussion

In this study, researchers examined educators' attitudes toward technology integration and relationships between educators' perceived usefulness and perceived ease of use of technology. The review of related literature revealed that there was extensive literature addressing different topics in technology integration around the world. Findings from this study arrived from analysis of both quantitative and qualitative data and pointed some implications for educators, administrators, and stakeholders in education. In this section, researchers present a discussion of findings related to research questions.

Researchers have conducted extensive studies that explore how educators' technology attitudes affect technology integration across the various level of education. In several contexts, they report that educators' positive attitudes toward technology determine to a larger extent the degree of technology acceptance and use for teaching (Hassad, 2013; Loague et al., 2018; Marzilli et al., 2014). In Nigerian, literature has shown that technology utilization is in early stages across all levels of education (Garba et al., 2013; Owolabi et al., 2013). Findings in this study correspond with findings from various studies related to educator attitudes toward technology integration for teaching. For example, Marzilli et al. (2014) report that educators' positive attitudes toward technology have influenced their decision for utilization and adoption of technology for teaching. Correspondingly, Hassad (2013) found that faculty in higher education have a moderate attitude toward technology integration and there was a statistically significant correlation between educators' moderate attitude and technology acceptance and utilization for teaching. Findings from this study have shown that educators exhibit a positive attitude toward technology integration for teaching. The majority of educators agreed that the use of technologies (both instructional and web-based) for teaching is important. The qualitative findings substantiate the quantitative findings across the five colleges. Educators' positive attitudes could be ascribed to their passion for learning beyond the four walls of schools by attending technology professional developments in various avenues to improve their teaching in twenty-first-century education. Conversely, among ten educators interviewed, one educator indicated that educators exhibit a negative attitude toward technology. In line with this, some educators explain some barriers that may have to interfere with technology integration but did not deter their positive attitudes toward technology integration.

Researchers in various fields have used one or more components of the Technology Acceptance Model (TAM) to study the interplay of various factors determining technology acceptance (Echeng, et al, 2013; Fathema, et al, 2015; Holden and Karsh, 2010; Park, 2009). In educational settings, Alharbi and Drew (2014) report a strong positive correlation between educators' attitudes, perceived ease of use, perceived usefulness, and behavioral intentions to use a specific Learning Management System (LMS). In Nigeria, Echeng et al. (2013) suggest that educators' perceived usefulness and perceived ease of use define educators' behavioral intentions to accept and

use technology for teaching. Findings in this study also corroborated several research findings presented in the literature. We found a strong positive correlation between Nigerian teacher educators' perceived ease of use and perceived usefulness of technology which later informed their behavioral intentions to adopt and use the available technology for teaching. These findings elaborate more on educators' overall positive attitudes toward the integration of technology into teaching as reported in this study and other studies pointed out in the literature.

Implications for Educators and Stakeholders

Educators' attitudes toward technology determine to a greater extent its utilization for teaching. In this study, findings suggest that educators' positive attitudes toward the perceived usefulness and ease of use of technology determine their attitude toward the use of technology. The overall findings from the study revealed that educators' attitudes toward the use of technology were moderate. They accept and use the available instructional and web-based technologies for teaching.

Educators

There is a critical need for educators to develop interests to learn how to use different instructional and web-based technologies for teaching. This would enable educators to form positive attitudes toward technology and may influence their decision in accepting to use instructional and web-based technologies for teaching. While accepting technology is not enough, educators should also dedicate time for some technology professional development. This could be done through attending conferences, workshops, and seminars related to developing technology competence.

It is equally important for educators to help one another by forming a Professional Learning Networks (PLN) which can be departmental or college wide. Where they can engage in reading books related to technology integration and best practices related to the use of technology across disciplines. Another key area to focus on is the use of Open Educational Recourses (OER). Educators should learn to make use of OERs as they provide free cutting-edge practices and resources for educators to enhance their Technological and Pedagogical Knowledge (TPK) for effective teaching in twenty-first-century classrooms.

Administrators

Administrators across Nigerian teacher preparation colleges can play an important role in helping educators to accept and use technology for teaching. Administrators should work to provide enormous access to technology within the colleges and set some technology support centers (IT Support Centers) within each college. These centers should aim to provide educators and students with on-time technical support whenever the need arises. Administrators should also work to provide some technology professional development workshops and seminars for educators across all colleges. This could be done by inviting experts in the field of technology integration as guest speakers, keynote speakers, and even providing hands-on workshops for educators.

Directions for Future Research and Recommendations

This study examined the relationship between educators' attitudes, perceived usefulness, and perceived ease of use of instructional and web-based technologies and we found that educators exhibit a degree of positive attitudes toward the use of technology for teaching. Similarly, there was a strong positive relationship between perceived usefulness and ease of use of technology which later influence their behavioral intentions to use technology for teaching. Based on findings from this study, we recommend that researchers in Nigeria should consider the following as directions for future research:

1. Researchers should conduct a large-scale nationwide study to examine educators' technological and pedagogical knowledge that will enable them to make sound suggestions to administrators on areas of technology professional development.
2. Researchers should conduct a study to explore educators' technology comfort level and how it impacts their technology integration.
3. Researchers should also conduct a study that explores educators' technology needs. Knowledge of that will enable both administrators to provide technical support services across Nigerian campuses.
4. Researchers should conduct a large-scale global literature review on the impact of technology attitudes, perceived ease of use, and perceived usefulness of technology. Identify some research that standout and replicate them in the context of Nigerian educators.

Conclusion

The education during the COVID-19 pandemic experience has shown that technology has a special place in education. More than before, we learned that technology integration serves as a means that grants many people education access (Fu, 2013). Onyia and Onyia (2011) opine that technology-enhanced education could promote the acquisition of knowledge and skills leading to creating lifelong learners. Educators across all levels of education should learn how to integrate technology effectively to enhance their teaching. It is, therefore, imperative for educators to have positive attitudes toward technology integration and develop behavioral intentions to use it for teaching. The purpose of this study was to use Davis et al. (1989) Technology Acceptance Model (TAM) and examine Nigerian teacher educators' attitudes and use of instructional and web-based technologies in teacher preparation programs. TAM helped the researchers to describe the process involved in technology acceptance and adoption for teaching. Among other things, findings have shown that Nigerian teacher educators exhibit overall positive attitudes toward the use of instructional and web-based technologies for teaching. Similarly, findings revealed that there was a strong positive correlation between educators' technology attitudes, perceived usefulness, and perceived ease of use of technology which later translate to educators' behavioral intentions to accept and adopt technology for teaching. There is a need for educators and administrators to work together to make technology integration seamless to maximize students learning.

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Do Students' STEM Skill Levels Affect Their Math and Science Achievement?

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Do Students' STEM Skill Levels Affect Their Math and Science Achievement?

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Abstract

The aim of this study is to determine the academic achievements of 8th graders in mathematics and science courses and STEM skill levels. The research has been carried out with the survey model. The sample of the study consists of 251 8th grade students in the 2020-2021 academic year. Math and Science academic achievement tests and STEM skill levels scale was used for data gathering. The scores obtained within this framework have been analyzed using arithmetic mean, standard deviation, t and Pearson r correlation and regression analyses. As a result of the research, we have reached that the means of the students in science and mathematics courses are similar and low. STEM skill levels of male and female students have been found to be similar in terms of science, mathematics, engineering, and technology factors, but male students are more successful than female students in both math and science courses. It has also been found that STEM skill levels influence students' math and science academic achievements, and STEM skill level perceptions influenced students' math and science achievements.

Introduction

The Program for International Student Assessment (PISA), organized every 3 years by the Organization for Economic Cooperation and Development (OECD), is a program preferred by countries. A total of 600,000 students from 79 different countries participated in this program in 2018 (OECD, 2018a). The purpose of participating countries in this program is to increase their own reputation, to see the quality of education evaluated by an independent organization, and to contribute to their literacy in the fields of mathematics and science (Yıldırım, 2021). Turkey did not participate in the first program but participated in the second program in 2003. Since Turkey has implemented the projects of the International Association for the Evaluation of Educational Achievement (IEA), it has not been able to participate in the first implementation of the program. However, Turkey was able to participate in its second application in 2003 with 4,855 students (MONE, 2005). The results of the program conducted in 2018 were declared and students of OECD countries revealed a basic level of proficiency in the field of mathematics and science (OECD, 2018a). The OECD mean for mathematics is 76% for level 2 and above, and 11% for level 5 and above. The science course mean is 78% for level 2 and above, and 7% for level 5 and above. The mean literacy score was 77% for level 2 and above, and 9% for level 5 and above (OECD, 2018b). Turkey has remained below the OECD mean in all three areas of mathematics, science, and

literacy. The mean level of mathematics in Turkey was about 63% for level 2 and above, and 5% for level 5 and above. The science mean was about 75% for level 2 and above, and 2% for level 5 and above. The mean literacy rate was about 74% for level 2 and above, and 3% for level 5 and above (OECD, 2018b). This result suggests that students in the 15-year-old age group at the secondary and high school levels need a different teaching approach.

Students in the age group of 15 also participate in the "Central Examination on Secondary Education Institutions" conducted by the Ministry of National Education (MONE) in addition to these international exams, and the number of students participating in the exam varies by year. The number of students who took the exam in 2019 and 2020 was 1,029,555 and 1,472,088, respectively, and the participation rates were determined as 85.08% and 88.08% (MONE, 2019b, 2020). Students answer 20 questions in the science, mathematics, and Turkish courses, and 10 in the history of Turkish Republic of Revolution and Ataturkism, Religious Culture and Moral Knowledge, foreign languages courses (MONE, 2019b, 2020). The correct answer means of the courses are published in the evaluation reports of the exams. The means in the 2019 report were 9.97 in science and 5.09 in mathematics, while the means of other courses were 11.75, 6.88, 6.83 and 4.65, respectively. The means in the 2020 report were 10.2 in science and 4.39 in mathematics, while the means of other courses were 10.00; 5.05; 6.39 and 3.53, respectively (MONE, 2019b, 2020). Compared to the means of 2019 and 2020, there is an increase in science, while there is a decrease in mathematics and other courses.

Compared to the PISA and high school transition exam results, they were found to be the high school transition exam (Central Examination on Secondary Education Institutions) conducted in 2018 and 2019 included 2 of the math questions, 1 of the PISA proficiency levels, and 1 of the PISA proficiency levels (Öztürk & Masal, 2020). The two examination systems are evaluated when together, it is seen that the academic achievement of the students of the 15th age group in Turkey is low. Turkey's mean in the PISA exam remains below the OECD mean and there is a mean decrease in the high school transition exam (OECD, 2018b, MONE 2019b, 2020).

Students after 12 years of compulsory education, attend the Higher Education Institutions Examination (YKS) conducted by the Center of Student Election and Settlement (ÖSYM) when they want to study for a bachelor's degree. 2,296,137 candidates participated in the YKS, Basic Proficiency Test (TYT) session held in 2020 (ÖSYM, 2020). As we look at the results that are reflected in the 12 years of training of these candidates, it is seen that Turkey's overall academic success is low. The mean number of correct answers in Turkish (40 questions), Social Sciences (20 questions), Basic Mathematics (40 questions) and Science (20 questions) is calculated as respectively 18.23; 9, 13; 7.0 and 3.76 (ÖSYM, 2020). The fact that the mathematical and science achievements of individuals who will be trained in specialization in their professions are low in this way suggests that a different teaching approach is needed in 12 years of education for the future of the country. The 12-year education process has been modeled on other countries, but it is necessary to take the quality of their education as an example rather than just modeling the duration of the education (Babadağ & Sarıbaş, 2015). Education is vital in creating qualified human resources. In other words, quality education means quality graduates (Suratno, Wahono, Chang, Retnowati & Yushardi, 2020). The reason why the future of countries is associated with mathematics and science is because it is necessary for citizens to understand the scientific and technical problems affecting their lives (Matthews, 2007). Educational programs in Turkey were changed in 2018. It has been determined that there is no interdisciplinary

interaction in the curriculum and that the course hours and programs are inflexibly the result-oriented and the implementation parts are inadequate (Akgündüz et al., 2015). However, with the change approved by MONE (Ministry of National Education) in 2018, new curriculums were created in an integrated structure that attaches importance to individual differences, values and skills rather than simply conveying knowledge in order to educate individuals with 21st century skills. (MONE, 2018a, 2018b). The integration of curriculums between disciplines is seen as important in order to give students skills in line with their abilities. Countries such as the USA, Japan and UK use STEM education in their education systems and these countries' PISA and TIMSS results have increased (Sakarya, 2015).

In the 1990s, the acronym "SMET" was used by The National Science Foundation [NSF)] to refer to "science, mathematics, engineering and technology" (Sanders, 2009). However, Judith Ramaley, (2001) a former employee of the NSF, changed to "STEM" for the first time. (Ref: Breiner, Harkness, Johnson, & Koehler, 2012). But STEM education has a long history of launching Sputnik, the first Russian artificial satellite, into space in 1957, which shocked many states, especially the USA. According to Mervis (2010), the Sputnik crisis was described as the second STEM crisis, and the first was in the war, the invention of nuclear weapons of mass destruction and the establishment of the NSF were at stake with World War II. Technological developments in this period were important for reflecting countries. Atomic bombs, synthetic rubber, various means of transport indicated that the United States was a developing country. However, in the case of Sputnik, many countries, especially the United States and the United Kingdom, realized that they were lagging in STEM fields. The National Aeronautics and Space Administration (NASA) was established in the U.S. in 1958 and was responsible for many STEM education initiatives (White, 2014). STEM education has been an interdisciplinary and practice-oriented teaching approach and science, technology, engineering, and mathematics disciplines must be integrated (Akgündüz et al., 2015). STEM education congregates different disciplines to ensure meaningful learning, connecting real-life knowledge with learned knowledge. Therefore, meaningful learning is provided by a STEM program integrated into the courses (Yıldırım & Altun, 2015). Integrative STEM education increases students' achievements and keeps their interests and motivations high. A meta-analysis study by Becker and Park (2011) on how STEM with an integrative approach an impact on students' learning has, has concluded that the integrative approach improves student achievement. It is observed that students' interest in science and mathematics decreases at an early age in schools using traditional education methods, and therefore they move away from the two important disciplines of STEM education (Sanders, 2009). If the course activities are not organized to meet the needs of the students, if new strategies are not developed, it is seen that the participation in the course decreases with the internal motivation of the students (Akbaba, 2006).

The main purpose of STEM education is to provide students with the necessary knowledge in mathematics and science courses, while also gaining skills such as problem solving, critical thinking, creativity, and collaboration (Acar, Tertemiz & Taşdemir, 2019). "The Partnership for 21st Century Learning (P21)" is an organization that defines the integration of 21st century skills into education in the United States (P21, 2019). While mathematics and science are key subjects, creativity, critical thinking, communication, and collaboration are among the important skills for learning and innovation. Therefore, it is necessary to ensure that 21st century skills aimed at practice and learning are included in the 21st century curriculums (P21, 2019). STEM education aims to enable

the integrated branches of mathematics, science, technology, and engineering to be practiced in everyday life situations and to use students' theoretical knowledge in related fields (Yıldırım & Gelmez-Burakgazi, 2020). Research conducted by Acar and others (2019) found an association between students' mathematical achievements, science achievements and problem solving skills. Since STEM education is an integrated approach, success of students in both mathematics and science courses has increased. A study with 6th grade students conducted by Ergün and Balçın (2019) concluded that problem-based STEM activities increase students' achievements. Ceylan (2014) created the teaching design for acid and bases on the basis of STEM in an experimental study with 8th grade students and found that the academic achievements, creativity and problem solving skills of stem-based students increased more. An experimental study by Çakır and Ozan (2018) concluded that STEM activities further increase the success of math classes for 7th graders. In the semi-experimental study carried out by Yildirim and Selvi (2017) in 3 stages, it was concluded that STEM activities increase the academic achievement of 7th grade students in science course.

Many studies in this field reveals the necessity of STEM education. (Akgündüz et al., 2015; Altunel, 2018; Ayverdi & Öz Aydın, 2020; Çolakoğlu & Günay Gökben, 2017; PwcTürkiye & TÜSİAD, 2017). The disconnect between the skills that employers seek in their employees and the skills that employees acquire in school life reveals the necessity of STEM education and the current system does not reveal the skills needed. The trend towards STEM areas in Turkey is decreasing day by day. When the preferences between 2000 and 2014 were examined, the settlement rate of people who preferred STEM areas decreased from 85.63% in 2000 to 27.88% in 2010 and increased to 38.23% in 2014. (Akgündüz et al. 2015). According to these results, STEM-based education is a necessity for Turkey. In the so-called information age, these rates will be insufficient to meet the manpower the country needs. STEM education should be took part in the education system to help the country thrive and catch up with the age, and the next generation should be allowed to move to STEM fields. Studies on STEM should be carried out in the country so that social awareness should be raised, its applicability must be ensured, and it should be removed from being the subject of research only and a social renewal should be carried out in order to become a state policy (Akgündüz et al., 2015). The education system should be in a structure that teaches students to take responsibility, emphasizes the importance of solidarity, gives technological knowledge such as programming to students in the first years of their education, directs them to think and enables them to become entrepreneurs. If this structure cannot be created, it will not be possible to train individuals who master STEM disciplines and use their skills in these disciplines to develop products. Therefore, it will not be possible for Turkey to compete with other countries economically (Akgündüz et al., 2015).

Artificial intelligence, internet of things (IOT), intelligent life technologies, 3D design and production, space exploration, cyber security, virtual reality, augmented reality concepts are gaining importance and develops rapidly in these fields in this period called Industry 4.0 (Yıldırım, 2021). Due to the current developments, the importance of developing new methods and techniques related to education and to prefer school applications with an innovative approach suitable for the 21st century has increased even more (MONE, 2019a). Especially recently, STEM approach has become even more important. Because countries increase the quality of education by innovating in the fields of science, mathematics, technology, and engineering (Ulutan, 2018). The aim of interdisciplinary and application-based training is to prepare individuals for life. A real STEM education should

increase students' understanding of how things work and improve their use of technology (Bybee, 2010).

Science centres and many projects contribute to STEM education in Turkey. Istanbul Aydın University's "STEM For Disadvantaged Students Especially Girls" project, Aziz Sancar's "Girls in STEM" project are examples of projects in the country (Ulutan, 2018). TUBITAK (The Scientfic and Technological Research Council of Turkey) has completed the centre of science projects in Konya, Kayseri, Kocaeli and Bursa provinces. The centre of science in Elazig, Gaziantep, Antalya (Kepez), Sanliurfa, Istanbul (Uskudar), Düzce, Denizli continue their projects Afyonkarahisar, Karaman and Tokat provinces also have science centre projects that are in the application period. The aim of the science centres here is to enable individuals of various age groups with different backgrounds to communicate with science and understand science and technology, to make science accessible to them, to increase the importance of science in society, to carry out experimental and practical activities to raise awareness in this field, to move children to try and explore (TÜBİTAK, 2019). TUBITAK makes important contributions to STEM education with these studies.

The training of teachers who will train individuals with 21st century skills is also important. Trained teachers will not be enough to train the STEM-educated individuals we need only if they have the knowledge to teach in their field (Çorlu, Capraro and Capraro, 2014). If the science teacher just teaches the science field and does not integrate technology, mathematics, and engineering into his courses, he cannot be a STEM educator, even though he's in stem. He is just a science teacher (White, 2014). What is expected of teachers is not to give theoretical knowledge in science, mathematics, technology, engineering courses, but to be a role model, to encourage students to think at a high level, to enable them to develop products, to reach the level of invention and innovation. (MONE, 2016). STEM education is thought to benefit this education needed. Education systems based solely on reading, writing and arithmetic will not lead individuals to success in tomorrow's technological world (Dugger, 2010).

In the literature, STEM education is seen to make significant contributions to the academic achievement of students. McClain (2015) when compared the math achievements of students who did not receive STEM education, it found that students who received STEM education were more successful. In their study He, Li, Turel, Kuang, Zhao and He (2021), gave 2 months of STEM education to kindergarten students aged 5-6 years old. At the end of this process, it was determined that the mathematical skills of the students improved. Dedeturk, Kırmızıgül and Kaya (2020) also concluded that STEM activities increase students' achievements. This study was carried out as a semi-experimental study with 6th grade students on the sound of science course. In the study carried out by Ercan and Şahin (2015) with 7th grade students, it was determined that design-based science course increases students' achievements. With their work, Yaki, Saat, Sathasivam and Zulnaidi (2019) aimed to determine the effects of an integrated STEM education on science success and to identify the change in students with different academic abilities. To this end, they worked with 100 Nigerian science students in the 11th grade. T was noted that the academic abilities of the 51 students in the experimental group were different. While the experimental group took courses within the scope of STEM education, the other group took courses in the traditional method and the experimental group students were found to be more successful in science. However, there was no significant interaction between the teaching approach and the students' different academic abilities, and students with low academic abilities were the group with the most gains. Siregar, Rosli, Maat, and Capraro

(2019) aimed to synthesize research on STEM education and mathematical success through their meta-analysis work. In this study, experimental research published in 1998-2017 was discussed. As a result of the study, STEM was found to have an impact on mathematical success, but they did not obtain data on STEM's impact on mathematical success in terms of education level, publication source and duration of the experiment. Likewise, Suratno and others (2020) found that in their study with middle school students, students' academic achievements improved as well as problem solving skills. When the studies are examined, it can be said that STEM education has a positive effect in increasing the academic achievement of students, as well as contributing to the development of 21st century skills such as problem solving and creativity. With this study, it was desired to determine the STEM skill levels of 8th grade students and the achievements of mathematics and science courses according to the renewed curriculum. In this context, the aim of the research is to examine the achievements of 8th grade students in mathematics and science courses within the framework of STEM skill levels.

Research Questions

Is there a correlation between the math and science course achievements of 8th graders and STEM skill levels?

- What are the perceptions of STEM skill levels and academic achievements?
- Is the perceptions of STEM skill levels and academic achievements differing according to the gender of the students?
- Is Stem skill levels have any impact on mathematics course success?
- Is Stem skill levels have any impact on science success?
- Is there a correlation between STEM skill levels and mathematics and science success levels?
- Does STEM skill levels predict their success levels of mathematics and science?

Method

Research Model

In this study, a survey model from quantitative research was preferred to determine the math and science achievements and STEM skill levels of 8th grade students. The characteristics of the situation experienced are determined and evaluated within the framework of the standards and possible relationships are determined in the descriptive studies. The purpose of this type of research is to define its relevant status, to explain it thoroughly (Çepni, 2012).

Participants

The participants of this research consists of 251 students, including 111 females and 140 males, who were in the 8th grade in the 2020-2021 academic year during pandemic. Convenience sampling method was used in the selection of students. First, 8th graders were reached through their teachers and asked to complete success tests with scale. For this purpose, teachers were contacted on social platforms and asked to provide a link to the data collection tool to 8th grade students. Then, a link was sent directly to the 8th graders from social platforms, and

they were asked to provide this link to the 8th grade students they knew. Teachers and students who are communicated in daily life were also asked to forward the link to 8th grade students. This contributed to the distribution of the link to 8th grade students who were educated at the same school. Thus, 251 8th graders were reached.

Instruments

Mathematics Achievement Test

The mathematics achievement test was created from the subjects in the 1st semester of the 8th grade. These topics are: "multipliers and multiples", "exponential expressions", "squared expressions", "data analysis", "probability of simple events", "algebraic expressions and identifications". There are 27 objectives related to these subjects in the current curriculum of MONE mathematics course. In this study, 2 objectives related to probability were not included and a 25-gain test was created. There are 5 objectives related to probability. When asked each question about all 5 objectives it was thought that the question distribution would be more than the amount of question of the probability subject. Therefore, it was preferred that the two objectives at the basic level should not be included in the test. The item pool was selected among the questions that were previously used in the national exams held by MONE. 30 questions were determined considering the objectives from this question pool. This 30-question success test was finalized with the opinion of five primary math's teachers. Thus, a 30-question success test was developed to determine the 1st semester math achievement scores of the 8th graders who participated in the study. According to the results obtained from the study group of the achievement test prepared, Kr-20 value was determined as 0.95, mean of difficulty index was determined as 0.61 and the distinctiveness values of the questions were summarized in Table 1.

Table 1. Distinctiveness Index of the Items of the Mathematics Course Achievement Test

Item No	Distinctiveness	Item No	Distinctiveness
I1	0.5	I16	0.868
I2	0.809	I17	0.897
I3	0.706	I18	0.809
I4	0.721	I19	0.632
I5	**0.294**	I20	0.794
I6	0.632	I21	0.779
I7	0.853	I22	0.794
I8	0.765	I23	0.779
I9	0.735	I24	0.794
I10	0.706	I25	0.721
I11	0.721	I26	0.824
I12	0.632	I27	0.779
I13	0.809	I28	0.853
I14	0.794	I29	0.706
I15	0.721	I30	0.632

When Table 1 is examined, all questions except the 5. question, have a fairly good level of item discrimination, it is observed that the item 5 is very close to 0.3. Accordingly, it was not necessary to take questions from the academic achievement test. Accordingly, it is possible to say that the scale of students is valid and reliably measure the academic achievements for the objectives related to the first semester period of 8th grade.

Science Course Achievement Test

The test was formed by the subjects of the 8th grade. These topics are: "World and Universe", "Living Things and Life", "Physical Events", "Substance and Nature". MONE Sciences course is 36 objectives related to these issues in the current teaching curriculum. However, most of these 30 objectives are generally included in the 1st period. Therefore, the objectives following the 30th objectives were not used in this study. 5 of the 30 objectives in the 1st period were not included and a 25-objective science success test was created. It was preferred not to include these objectives in the test. Since the two objectives on acids are related to observation and taking precautions, the two objectives related to biotechnology are discussion and prediction and the objective related to adaptation is connected to observation and explanation and considering the distribution of questions of the subjects. The item pool was selected among the questions that were previously used in the national exams held by MONE. 30 questions were determined considering the objectives from this question pool. This 30-question achievement test was finalized with the opinion of two science teachers. Thus, a 30-question achievement test was developed to determine the 1st semester science achievement scores of the 8th grade students who participated in the study. According to the results obtained from the study group of the achievement test prepared, Kr-20 value was determined as 0.94, mean of difficulty index was determined as 0.60 and the Distinctiveness values of the questions were summarized in Table 2.

Table 2. Distinguishing Index of the Items of the Science Course Achievement Test

Item No	Distinctiveness	Item No	Distinctiveness
I1	0.632	I16	0.721
I2	0.750	I17	0.353
I3	0.735	I18	0.794
I4	0.721	I19	0.779
I5	**0.294**	I20	0.618
I6	0.779	I21	0.676
I7	0.794	I22	0.559
I8	0.824	I23	0.779
I9	0.809	I24	0.294
I10	**0.294**	I25	0.588
I11	0.779	I26	0.838
I12	0.809	I27	0.853
I13	0.779	I28	0.779
I14	0.765	I29	0.824
I15	0.794	I30	0.809

When Table 2 is examined, all questions except the 5.and 10th question, have a fairly good level of item discrimination, it is observed that the item 5 and 10th are very close to 0.3. Accordingly, it was not necessary to take questions from the academic achievement test and it can be said that the scale can measure the academic achievements of the students for the objectives of the 8th grade 1st semester of the science course in a valid and reliable way.

STEM Skill Levels Perception Scale

STEM Skill Levels Perception Scale", was designed by Korkmaz, Çakır and Uğur Erdoğmuş (2021). By this scale, it is aimed to determine the basic STEM skill levels of middle school students. The scale consisting of 23 items and 3 sub-factors is arranged in the type of 7 Likert. There is a rating of "1:I do not agree at all and 7: I strongly agree." 11 items in the science sub-factor have an internal coefficient of consistency of 0.899. There are 6 items in the sub-factor of engineering and technology and have an internal coefficient of consistency of 0.858. Finally, there is th6e 6-items mathematical sub-factor and has an internal coefficient of consistency of 0.800. The internal consistency coefficient value for the whole scale is also determined as 0.940. The KMO value calculated for 23 items and three factors is 0.960, and the values of the Bartlett test are $\varepsilon 2 = 5100.\ 5;\ df = 253;\ p < 0.001$. Factor loading of items have values between 412 and 0.638. The variance values explained by science, engineering and technology and mathematical factors are 22.67, 16.30, 13.2, respectively, and the total variance described is 52.23%. Correlation coefficients of the first factor range from 0.651 to 0.730, the second in the range of 0.681 to 0.759, and the third in the range of 0.632 to 0.747. Item differentiation values range from 13,123 to 22,753 and total item differentiation is 44,798. The distinguishing values of science, engineering and technology, mathematics sub-factors are 37,953, respectively; 31.593; 26,332.

Data Collection

The data was collected through the Google Form. In the first part of the form, some information about the content of the study is presented. It has been made clear that sincere answers are expected from students and that the data will not be used anywhere other than the study. In the following part of the form, there is a "demographic information" section, a "STEM Skill Levels Perception Scale" section, a "Math Success Test" section, and a "Science Success Test" section. The students completed the form by filling out these departments respectively.

Data Analysis

To determine whether parametric analyses can be performed on the collected data, it is analyzed whether the data is distributed normally, and the results are presented in Table 3. When Table 3 is examined, it is seen that the level of significant of the data collected for all three scales is less than 0.05, in other words, the data is not distributed normally according to the results of the Kolmogorov-Smirnov test. However, since the Skewness and kurtosis coefficients are examined, it is seen that these coefficients are between +1.5 and -1.5 and the data can be considered normal accordingly (Büyüköztürk, 2016). On the other hand, Levene's test was used to examine whether the variances were homogeneous, and it was seen that the variances were homogeneous as a result. The

scores obtained within this framework have been analyzed using arithmetic mean, standard deviation, t and Pearson r correlation and regression analyses. Academic achievement test scores have been converted to a system of 100. In addition, according to the STEM total score, students are divided into three skill levels. When determining these levels, the highest score (23 items x 7 Likert) from the STEM skill levels scale has been calculated as 161, divided by 3 and a success interval of 54 points is determined. Thus, students with a score between 0-54 have been grouped as students with lower, 55-109 points, middle and 110-161 students with high-level STEM skills. However, this level is not participated in the analysis because the number of students at the lower level have been only 4.

Table 3. Normality Test Results

Factors		Kolmogorov-Smirnov (Sig.)	Skewness	Kurtosis
STEM Skill Levels	F1: Science	0.000	-0.621	-0.101
	F2: Mathematics	0.000	-0.943	0.752
	F3: Engineering and Technology	0.000	-0.710	0.257
	Total Points	0.003		
Mathematics Academic Achievement		0.000	-0.320	-1.447
Science Academic Achievement		0.000	-0.548	-1.219

Findings

Descriptive Findings

Students' perceptions of STEM skill levels are summarized in Table 4.

Table 4. Students' STEM Skill Levels

Factors		N	Low	High	M	SD	Low D	Mid DG.	High D
STEM Skill Levels	F1: Science	251	11	77	58.2	12.7	-	-	-
	F2: Mathematics		6	42	34.1	6.7	-	-	-
	F3: Engineering and Technology		4	42	30.5	8.2	-	-	-
	Total Points		23	161	122.7	25.9	4	72	175
Mathematics Academic Achievement			0	100	61.1				
Science Academic Achievement			0	93	60.1				

When Table 4 is examined, it is seen that the perception scores of the students regarding STEM skill levels ranged from 23 to 161 and the mean was 122.7. If examined in terms of their level, it is that only 4 of the students perceived their STEM skills as lower, 72 as medium and 175 as high level. When examined in terms of factors, it is seen that the mean in the science factor is 58.2, the mathematics factor is 34.1 and the Engineering and Technology factor is 30.5. Accordingly, it can be said that stem skill levels are high according to the perceptions of the students, 72 students perceive themselves at a moderate level and 175 students perceive themselves at a

high level. When analyzed the academic achievements of the students, it is seen that the mean for the mathematics course is 61.1 and the mean for the science course is 60.1. It can be said that the means of the students in science and mathematics class are similar and low according to the results.

Changes in Term of Demographics

Students' STEM skill levels and academic achievements by gender are summarized in Table 5.

Table 5. Students' STEM Skill Levels and Academic Achievements by Gender

			N	M	SD	t	df	p
STEM Skill Levels	F1: Science	Female	111	58.1	13.0	0.027	249	0.978
	F2: Mathematics	Male	140	58.1	12.7			
	F3: Engineering and Technology	Female	111	33.8	6.6	-0.745		0.457
	Total Points	Male	140	34.4	6.7			
	F1: Science	Female	111	30.0	8.5	-0.766		0.445
	F2: Mathematics	Male	140	30.8	8.0			
	F3: Engineering and Technology	Female	111	121.9	26.0	-0.423		0.673
		Male	140	123.3	25.8			
Mathematics Academic Achievement		Female	111	54.1	29.3	-3.259		0.001
		Male	140	66.5	30.6			
Mathematics Academic Achievement		Female	111	56.2	28.6	-2.115		0.036
		Male	40	63.7	7.9			

When table 5 is examined, the mean of students' STEM skill levels in terms of total scores is 121.9 for females and 123.3 for males. In this case, it can be said that the mean of males is higher than the mean of females. However, there is no statistically significant difference between males and females *(t (251) = -0.423; p>0.05)*. It can be accordingly concluded that the STEM skill levels of the male and female students in terms of total score are similar. In the factor of science courses, the means of students' STEM skill levels were 58.1 for both females and males. It can be said in this case, that the mean of females is equal to the mean of males. There is no statistically significant difference between males and females *(t (251) = 0.027; p>0. 05)*. Accordingly, STEM skill levels of male and female students are similar in terms of science course factor. In the mathematical course factor, the mean of students' STEM skill levels was 33.8 for females and 34.4 for males. It can be revealed then that the mean of males is higher than the mean of females. However, there is no statistically significant difference between males and females *(t (251) = -0.745; p>0.05)*. Accordingly, STEM skill levels of male and female students are similar in terms of math course factor.

In the factor of engineering and technology, the mean of students' STEM skill levels was 30.0 for females and 30.8 for males. In this case, it can be said that the mean of males is higher than the mean of females. However, there is no statistically significant difference between males and females *($t_{(251)}$ = -0.766; p>0.05)*. Accordingly, STEM skill levels of male and female students are similar in terms of engineering and technological factors. As

the academic achievements of the students are examined, it is reveals that the mean for mathematics course is 54.1 for females and 66.5 for males. It can be in this case, said that the mean of males is higher than the mean of females. It may be stated that there is a statistically significant difference between males and females in terms of mathematical academic success $(t_{(251)} = -3.259, p<0.05)$. It can be thereby verbalized that male students are more successful in mathematics than female students.

The mean for science classes is 56.2 for females and 63.7 for males. In this case, it can be said that the mean of males is higher than the mean of females. There is a statistically significant difference between males and females in terms of science academic achievement $(t_{(251)} = -2.115, p<0.05)$. Accordingly, it can be verbalized that male students are more successful in science class than female students. Since there are only 4 students with lower STEM skill level perceptions, this group was not included in the analysis when examining the effect of STEM skill level perceptions on math. The impact of STEM skill levels on math success of a total of 247 students at medium and high achievement levels is summarized in Table 6.

Table 6. Differentiation in Mathematics Academic Achievement of Students according to STEM Levels

		N	M	SD	t	df	p
Mathematical Academic Achievement	Medium	72	44.6	27.5	-5.946	245	0.000
	High	175	68.5	29.1			

When table 6 is examined, it is seen that the mean of 72 students with moderate STEM skill level perceptions is 44.6 and the mean of 175 students at the upper level is 68.5. In this case, it can be said that the mean of the group with high perceptions of STEM skill level is higher than the mean of the group with mid-levels. In terms of mathematical academic achievement, there is a significant difference between the group with a mid-perception of STEM skill level and the group with a high perception of STEM skill level $(t_{(247)} = -5.946, p<0.05)$. It can be worded thus that students with high perception of STEM skill level in mathematics class are more successful than students with mid perception of STEM skill level, in other words, STEM skill levels affect students' mathematical academic achievements. Since there are only 4 students with low STEM skill level perceptions, this group was not included in the analysis when examining the impact of STEM skill level perceptions on science. The impact of STEM skill levels of 247 mid and high level of students on science success is summarized in Table 7.

Table 7. Differentiation Science Academic Achievement of Students according to STEM Levels

		N	M	SD	t	df	p
Academic Achievement of Science Course	Medium	72	43.2	27.8	-6.818	245	0.000
	High	175	68.1	25.3			

When table 7 is examined, it is seen that the mean of 72 students with moderate STEM skill level perceptions is 43.2 and the mean of 175 students at the upper level is 68.1. In this case, it can be said that the mean of the group with high perceptions of STEM skill level is higher than the mean of the group with mid-levels. In terms of academic success of the science course, it is understood that there is a significant difference between the group with a mid-perception of STEM skill level and the group with a high perception of STEM skill level. As an

academic success of the science course, it is revealed that there is a significant difference between the group with a mid-perception of STEM skill level and the group with a high perception of STEM skill level $(t(247) = -6.818, p<0.05)$. Accordingly, it can be observed that students with high perception of STEM skill level in science class are more successful than students with mid perception of STEM skill level, in other words, STEM skill levels affect students' academic achievements in science.

Correlational Findings

The relationship between students' perceptions of STEM skill levels and their academic achievement levels in mathematics and science is summarized in Table 8.

Table 8. Relationship between Perceptions of STEM Skill Levels and Math and Science Achievement Levels

	Mathematical Academic Achievement	Science Academic Achievement
F1: Science	0.335(**)	0.346(**)
F2: Mathematics	0.459(**)	0.484(**)
F3: Engineering and Technology	0.391(**)	0.399(**)
STEM Perception Total Score	0.408(**)	0.423(**)

**p<0.01, N=251

When table 8 is examined, it is seen that the STEM skill level perception scale has a positively significant relationship with the science factor's mathematical academic achievement *(r = 0.335)* and science course academic achievement *(r = 0.346) (p<0, 05)*. It is also figured out this relationship is significant and positive between factors related to STEM skill levels and academic achievements in mathematics and science. Accordingly, it can be said that students' self-perception of STEM skills is associated with their academic achievements in mathematics and science courses in terms of both total and factor scores, and their academic achievements in mathematics and science courses increase as their perception of STEM skill levels increases. The procedure of mathematical academic achievement of students' STEM skill levels is stated in Table 9.

Table 9. Prediction of STEM Skill Levels to Mathematical Academic Achievement Levels

Variable	B	SE_B	β	β^2	t	p
Stable	1.749	8.582	-	-	0.204	.839
STEM Skill Levels Perception	0.483	0.068	0.408	0.166	7.058	0.000

$R=0.408$, $R^2=0.166$; $F(1, 249)= 49.820$, $p=0.000$; Y=1.749+0,483 STEM

When the results of regression analysis are examined in Table 9, it is seen that students' perception of STEM skill level explains 16% of the variance in math academic achievement scores *($F_{(1, 249)} = 49.820, p = 0.000$)*. It may be expressed that the calculated value of *F = 49.820* and its *p = 0.000* significant level for the significant of the regression model are the same as the F value for the significant of the model in ANCOVA application, and the variance described by the regression model is equal to the variance described by the ANCONA model.

Accordingly, it can be said that the perceptions of the variable STEM skill level independent of the analysis are the drivers of the students' math academic achievement scores, in other words, they have an impact on the mathematical achievements of my students. The findings of students' perceptions of STEM skill level fatigue their academic achievements are figured out in Table 10.

Table 10. Prediction of STEM Skill Levels to Science Academic Achievement Levels

Variable	B	SE_B	β	β^2	t	P
Stable	3.387	7.906	-	-	0.428	.669
STEM Skill Levels Perception	0.464	0.063	0.423	0.178	7.368	0.000

$R=0,423$ $R^2=0,178$; $F(1, 249)= 54,281$, $p=0,000$; $Y=3,387+0,464$ STEM

When the results of regression analysis are examined in Table 10, it is seen that students' perceptions of STEM skill level explain 18% of the variance in science academic achievement scores *($F_{(1, 249)} = 54,281$, $p = 0,000$)*. It may be expressed that the calculated value of *$F = 54,281$* and its *$p = 0.000$* significant level for the significant of the regression model are the same as the F value for the meaningfulness of the model in ANCOVA application, and the variance described by the regression model is equal to the variance described by the ANCONA model. Accordingly, it can be mentioned that the perceptions of the variable STEM skill level independent of the analysis are the drivers of the students' science academic achievement scores, in other words, they have an impact on the students' science achievements.

Discussion, Conclusions and Recommendations

The aim of the research is to examine the achievements of 8th grade students in mathematics and science courses within the framework of STEM skill levels. Within the framework of this aim, the following results have been achieved: In terms of factors, the mean STEM skill levels of the students were 58.2, 34.1, 30.5, respectively, for science, mathematics, engineering, and technology. According to the perceptions of the students, STEM skill levels are high. Of the 251 students, 175 are at the top level, 72 are at the intermediate level and 4 are at the lower level. Korkmaz, Çakır and Uğur Erdoğmuş (2021) determined their STEM skill levels as relatively low in science and mathematics and engineering and technology in their scale adaptation study with 501 secondary school students. Adsay, Korkmaz, Çakır and Uğur Erdoğmuş (2020) found the STEM skill levels of middle school students as moderate in their study with 202 secondary school students. The results of the studies are supportive of each other. It can be said that the academic achievements of the 8th grade students in this study are similar and low in science and mathematics. STEM skill levels can be compared based on their differences in academic achievement by studying with another sample group. Korkmaz, Acar, Çakır, Uğur Erdoğmuş and Çakır (2019) carried out semi-experimental research in quantitative dimension of the study they carried out with mixed research method. The effect of Lego Mindstorms Ev3 based on educational robot sets activities on students' STEM skill levels and attitudes towards science course was determined. As a result of this study, it was found that the perception of STEM skills of the students in the experimental group increased more than the other group. On a factor basis, there was a significant differentiation in science, engineering, and technology factors except

mathematics. Suprapto (2016) investigated Indonesian students' attitudes towards STEM. Mathematics is first, science is second, and then attitudes towards STEM has followed them. It was also found that there was a significant corral between attitude sizes towards STEM.

STEM skill levels of male and female students are similar in terms of science, mathematics, engineering, and technology factors. Their mean STEM skill level was 121.9 for females and 123.3 for males, but there was no statistically significant difference between males and females. In their study, Author. (2021) found that there was no gender difference in science, engineering, and technology factors, but that females in mathematics had a higher skill level than males. It can be said that this differences in mathematics may have been due to the student distributions in the sample. In their study conducted by Korkmaz, Çakır and Uğur Erdoğmuş (2021), females are 245 and males are 256. In this study, 111 of the 251 students are females and 140 were males. A study where the numbers of females and males are closer, this sub-problem can be re-evaluated.

When the academic achievements of the students were examined according to their gender, it was determined that male students were more successful than female students in both mathematics and science courses. It is seen that the means of mathematics and science were 54.1, 56.2 of females and 66.5 and 63.7 of males respectively, and this difference was found to be statistically significant. Ergün and Balçın (2019) found that problem-based STEM education improved students' achievements in an experimental study with 6th grade students, but although it affected females' achievements more positively than males' achievements, statistically no significant differences were found in students' achievements according to their gender. The study conducted by Ayaz, Gulen and Gök (2020) found that the use of e-portfolios in STEM education increased academic achievement, but no difference in students' achievements according to their gender. The research, conducted by Kulturel-Konak, D'Allegro, and Dickinson (2011), reviewed gender differences in learning styles and presented recommendations for STEM education. In this study, it was stated that STEM courses can be an obstacle for females because they prefer hands-on learning, while males prefer analytical thinking. Meadows (2018) examined the sense of STEM belonging of successful middle school students and found that there was no difference between males and females. Cahalan et al. (2000) examined gender differences in advanced mathematics and females are achieved more successful results than males. They found that the difference between females was greater in items that required spatial skills, shortcuts, or multiple solutions.

STEM skill level perceptions have an impact on students' math and science achievements. Students' self-perception of STEM skills is associated with their academic achievements in math and science courses in terms of both total and factor scores. In other words, as students' perceptions of STEM skill levels increase, so does their academic achievements in math and science. According to the results of their study with the 8th grade students of Kahraman and Dogan (2020), highly motivated students during STEM activities prove successful studies. Dogan (2019) exhibited the effect of STEM activities on students' scientific process skills, science attitude and STEM attitude and achievements in a mixed-method study with 7th grade students. According to the results of this study, the academic achievements of the experimental group students were found to be higher. Students have expressed that STEM activities increase their interest and knowledge of the course. As a result of the study carried out by Knezek et al. (2013), it was determined that in addition to understanding stem content knowledge, students also

developed an improvement in their creativity, perception of STEM subjects and careers. Owston et al. (2020) aimed to determine whether there was a difference in performance and perception among students who received STEM education and did not receive STEM education. STEM students performed better, but they were also found to perceive lessons more negatively. When analyzed the results of the studies, the thoughts and feelings of the students affect the success of the course. Therefore, students' achievements vary depending on how they perceive stem skill levels. The success of the 8th graders in the study in mathematics and science is also rising as their perception of STEM skill level is found to be high. In this context, the following recommendations can be made:

- In order for STEM activities to be used more effectively in classes, teachers can be supported more in relation to STEM applications.
- Since there is a corral between students' academic achievements and STEM education, STEM activities can be included more in the courses to increase students' academic achievements.
- STEM skill levels affect students' math and science academic achievements. In both math and science courses, male students were found to be more successful than female students. Therefore, STEM activities can be carried out that will change females' perceptions to increase their success.

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Effectiveness of Mobile Assisted Language Learning (MALL)-Based Intervention on Developing Thai EFL Learners' Oral Accuracy

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Effectiveness of Mobile Assisted Language Learning (MALL)-Based Intervention on Developing Thai EFL Learners' Oral Accuracy

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Abstract

With the rapid growth of digital technology, mobile phones are widely used for EFL teaching and learning. However, little is known about the effectiveness of integrating a mobile application into EFL classrooms to improve oral accuracy in Thai school contexts. An instructional intervention grounded with Mobile Assisted Language Learning (MALL) and dynamic assessment in Thai EFL contexts needs to be further investigated. This quasi – experimental study aimed to investigate the effectiveness of a mobile-based intervention to develop Thai EFL learners' speaking. Thirty students from a secondary school in southern Thailand were assigned to complete five oral tasks through the dynamic assessment process as an intervention on WhatsApp in order to develop their oral accuracy. Quantitative data were collected from the oral pre-test and post-test to examine the students' speaking development by utilizing the paired samples t-test. The results showed a significant difference between the pre-test and post-test after the implementation of the MALL-based intervention. It could be suggested that the application of the MALL-based intervention could develop EFL learners' oral accuracy in Thai school contexts. Implementations and recommendations of this study are discussed.

Introduction

Today, digital technology has played important roles in English as a Foreign Language (EFL) contexts. Literature has suggested that EFL teachers should integrate technology into their teaching through designing appropriate activities as a medium connecting between the instructor and learners in order to enhance 21st Century skills (Eaton, 2010; Gurgenidze, 2018; Joldanova et al., 2022). In addition, teachers can utilize mobile technologies such as mobile devices to promote EFL leaners' 21st century learning skills (Howlett & Waemusa, 2019). In terms of educational applications, the features of mobile devices can be leveraged to encourage unconfident learners to personalize their own learning and facilitate these learners through collaborative learning to access information anytime and anywhere (Kukulska-Hulme, 2018).

The concept of mobile devices as mediated tools in the pedagogical process and the mobile-assisted language learning (MALL) approach has been introduced through using mobile devices to improve language learning (Chinnery, 2006). MALL-based studies which investigated language learning improvement advocated the

effectiveness of MALL (Kamasak et al., 2021; Xu, 2020) through technology affordance via audio, video, text, image, and interactive features of mobile devices. A recent study reported that Thai EFL learners at high schools had difficulties in producing accuracy in language learning (Tanmongkola et al., 2020). Despite the advocacy of MALL applications, little has been known about how the integration of MALL in supporting language learning among Thai EFL learners, especially their speaking skills and oral accuracy.

With the evidence of MALL effectiveness in language learning (Alkhudair, 2020; Chang & Lan, 2021; Indrastana & Rinda, 2021), it is suggested integrating MALL with dynamic assessment (DA) into the process of pedagogical intervention, which should be promoted in order to enhance EFL students' oral accuracy. Inspired from Vygotsky's Sociocultural Theory, such DA intervention is applied to evaluate learners' performance while also promoting learning development through mediation in order to support learners' learning at different learning stages (Lantolf & Poehner, 2007). A MALL-based intervention can boost a collaborative space between learners and a teacher through dynamic assessment.

In EFL contexts, many studies showed the positive effects of using DA to enhance learners' speaking skills (Sun et al., 2017; Xu, 2020) and also to increase the positive perception among learners (Ahn & Lee, 2016; Almadhady, 2021). However, most of the studies in DA to enhance speaking skills in EFL contexts have only been conducted in face-to-face environments. It is challenging to investigate some appropriate mediation to integrate with DA (Lidz & Gindis, 2003). A mobile phone as a mediation should be integrated with DA and some studies reveal the positive effect of mobile-based dynamic assessment to enhance general language skills (Andujar, 2020; Ebadi & Bashir, 2021; Moeinpour et al., 2019; Rad, 2021).

Language teachers should understand the opportunities technology offers when designing and introducing a technology-integrated language classroom activity (Sharma & Hannafin, 2007). Choosing a mobile application to support activities and peer collaboration of the DA process is challenging, especially during the COVID 19 pandemic when learners are distant from school and they may not be familiar with a chosen technology. WhatsApp, a mobile application, has more than two billion active users worldwide and it is ranked as the most used mobile messenger app in the world (Dean, 2021a). In terms of language learning, many studies indicated that WhatsApp can be applied to facilitate learners' learning, for example to improve their speaking skills (Akkara et al., 2020; Andújar-Vaca & Cruz-Martínez, 2017) and positive attitude (Tahounehchi, 2021). With timely feedback in text massages, pictures and resource files, learners are also able to access materials anytime and anywhere (Sibplang, 2021). Theoretically, WhatsApp can provide learning opportunities to learners when it is used in a MALL-based intervention with the DA process to boost speaking skills.

Developing speaking skills for accuracy in EFL contexts is still challenging for researchers and educators. Speaking skills are significant for communication, consisting of accuracy, fluency and complexity (Skehan & Foster, 1997), all of which necessitate L2 learners' language proficiency. In her reviews, Chu (2011) mentioned that accuracy seems to be disregarded in development speaking skills of EFL learners. From Chu's (2011) remark, fluency becomes dominating in EFL research while accuracy and complexity are analyzed to be parts of fluency. In addition, well-known teaching methods in EFL contexts such as communicative language teaching and task-

based language teaching are meant to focus on learners' fluency.

During the COVID 19 pandemic, most Thai schools have shifted to online learning, and mobile devices have become prevalent among Thai learners when learning online (Petchprasert, 2020). In Thailand, mobile devices are important in learning online and could become a mediator between teachers and learners through various integrated approaches (Thaoyabut et al., 2021; Wongsuriya, 2020). Yet, little is known about the effectiveness of how to integrate MALL with DA process via WhatsApp on enhancing EFL learners' oral accuracy, a learning problem which still exists in Thai school contexts (Tanmongkola et al., 2020). The integration of DA within the MALL approach intervention via WhatsApp should be investigated to help Thai EFL students who need support from online teachers with learning online during the epidemic COVID-19 situation in Thai EFL contexts. Due to the school closure policy (Lao, 2020), this intervention can address the educational need where online learning takes place and teachers as well as students should shift their pedagogical practices from onsite to online settings. To cope with this gap, this study attempts to explore the effects of a MALL-based intervention with the DA process on Thai EFL learners' oral accuracy.

Background

MALL and Its Educational Values

Mobile Assisted Language Learning (MALL) is a learning approach that utilizes mobile devices such as mobile phones, tablets, MP3 players, podcasting to improve language competency (Chinnery, 2006). To Chinnery, the portability and connection of mobile devices are two of their most important features. In terms of connectivity, the mobile system must be able to connect and communicate with the learning website utilizing the device's wireless network to access learning material including short messaging service (SMS) and e-mail (Miangah & Nezarat, 2012). If learners' learning devices are movable, the learners can move the devices around and bring their learning resources with them (Huang & Sun, 2010).

In educational contexts, it is claimed that the use of mobile technology can facilitate leaners' 21st century learning skills (Howlett & Waemusa, 2019). According to the Framework for 21st Century Learning (Battele for Kids, 2019), the education in this century has gained importance in terms of ensuring that students develop their innovation, creativity, and teamwork, and they should learn how to apply those life skills to everyday activities. The use of mobile devices can facilitate learners to achieve these goals. Using mobile devices as an accessible mediation to provide feedback can share learning experiences between a teacher and learners (Godwin-Jones, 2011). It is suggested the use of mobile devices as mediation to collaborate in language learning can enhance speaking skills (Kukulska-Hulme & Shield, 2007).

With the support of MALL tools, EFL learners can be provided with learning resources through audio, video, text, image and interactive features of mobile devices to get exposed to authentic language learning (Chinnery, 2006). From the MALL perspective, it could be argued that it is not always necessary for EFL learners to study a language in a school setting (Chusanachoti, 2009) because their learning can be on their mobile devices whenever and wherever they prefer based on their learning style (Miangah & Nezarat, 2012).

Dynamic Assessment and Language Learning

Dynamic Assessment (DA) is a pedagogical approach which integrates teaching with evaluation, and teachers can provide consistent and effective assistance based on learners' development goals (Lidz & Peña, 1996). Influenced by Vygotsky's Zone of Proximal Development (ZPD), this approach is utilized to assess learner performance in relation to their ZPD (Lantolf & Poehner, 2011; Poehner & Lantolf, 2005). Vygotsky (1978) explains the ZPD is "the distance between the actual development level as determined by independent problem solving and the level of potential development as determined under adult guidance or in collaboration with more capable peers" (p. 86). When applied to a learning setting, ZPD implies that interactions between beginner learners and a more skilled and experienced person or More Knowledgeable Others (MKO), such as a teacher, can promote learning (Behrooznia, 2014) through the use of mediators. In the DA process, an MKO can adjust the level of mediation in order to fit a student's current level of performance through providing various forms of scaffolding such as a structure or set of guidelines, asking questions, and giving frequent feedback for accomplishing the task (Gallimore & Tharp, 1990).

In EFL contexts, previous studies on DA showed the enhancement of language skills and also indicated the positive effects of DA on language learning (Ebadi & Asakereh, 2017; Hessamy & Ghaderi, 2014; Khoshsima & Farokhipours, 2016), including speaking skills. However, DA-based studies which investigated speaking skills are limited in formal research contexts, especially in Thai school contexts, where teachers can provide learners with an opportunity to practice speaking between the teacher and learners through a designed intervention with feedback, learning resources, and digital technology as a mediated tool.

During the pandemic situation with school closure in Thailand, technology is an option to support language learning in this situation with communication without the limited time and place (Segev, 2014). The teacher can apply mobile technology to be a part of the dynamic assessment process as a mediator to provide appropriate scaffolding to support the learners in developing language learning in different skills.

WhatsApp as a MALL Tool and MDA

Mobile technology is ubiquitous these days and shapes human communication. WhatsApp, one of the most extensively utilized and popular communication mobile platforms by global users (Dean, 2021b), is a smartphone-based instant messaging application that allows users to send and receive messages in a variety of formats, including text, image, video, and voice messages (Church & De Oliveira, 2013). This mobile application can be chosen as the mediation between the teacher and learners to boost speaking skills (Khan et al., 2021; Mustafa, 2018). In addition, it is convenient for leaners to access learning resources on WhatsApp any time any place and can share messages with each other as collaborative learning (La Hanisi et al., 2018).

With the educational benefits of WhatsApp providing the supportive atmosphere as a learning community, it can be integrated with dynamic assessments because WhatsApp can support collaborative learning (La Hanisi et al., 2018). This integration can facilitate learners with communication between teachers and learners such as feedback,

suggestions and learning resources to enhance speaking skills. The teacher can take the advantages of these features of WhatsApp to design language leaning to enhance learners' speaking skills by providing an opportunity for communication between the teacher and learners.

In this current study, the researchers take the advantage of mobile devices and WhatsApp and used DA with scaffolding processes adapted from Lantolf and Poehner (2011), in order to support EFL learners to improve their speaking skills (Tarighat & Khodabakhsh, 2016). Lantolf and Poehner (2011) utilized DA as scaffolding processes in a language classroom to illustrate interactions between a Spanish teacher and learners. According to the scaffolding framework in their project, the instructor provided an inventory of teacher prompts consisting of eight hints in order to support learners to increase their language skills and this framework also was modulated and applied in this study. However, research on utilizing WhatsApp as a part of scaffolding process for enhancing the speaking skills of Thai EFL learners is limited and it is not clear how to scaffold EFL learners with timely feedback to improve oral accuracy on WhatsApp.

Related Literature about MALL-Based Interventions in EFL Speaking Skills

Researchers have given interest in the integration of mobile technologies for educational purposes and many favor this implication for enhancing language learning. Like other mobile devices, mobile phones, provided with internet access services and different applications, are considered as widespread tools and are used in language learning. Using mobile phones in language learning as MALL is still a great interest and a steady preoccupation of researchers over these 10 years (Panagiotis & Krystalli, 2020) including the MALL approach to enhance speaking.

Previous studies indicated the positive effects of WhatsApp on English language learning especially for developing speaking skills (Akkara et al., 2020; Mustafa, 2018) and supporting collaborative learning (La Hanisi et al., 2018). With the affordances of WhatsApp to support speaking skills via the scaffolding intervention, MALL-based intervention or MALL-based dynamic assessment (MDA), the term coined in the study of Rezaee et al. (2019), can provide a collaborative space and a learning opportunity for learners to use English as an extension of classroom discussion and allows teachers to provide additional practice and monitor students' learning achievements.

Although a few studies have investigated the integration of MALL with DA in enhancing language learning by using WhatsApp, little is known about Thai EFL school contexts. Rezaee et al. (2019), for example, investigated the effects of MDA on oral accuracy of pre-intermediate Iranian EFL learners who were assigned to complete tasks on WhatsApp by using a text-chat and a voice-chat in a higher education context. The post-test results indicated that there was the significant development of oral accuracy after providing feedback in each task on WhatsApp. Moreover, the text-chat group outperformed the voice-chat group in such development.

The outperforming results of a text-chat group over the voice-chat group with WhatsApp in enhancing language development was also confirmed later by the studies of Rezaee et al. (2020) and Ebadi and Bashir (2021). In

Rezaee et al.'s (2020) study, pre-intermediate learners of English completed eight oral tasks via text-chats, voice-chats on WhatsApp, and face-to-face to improve oral fluency. These learners received the dynamic assessment intervention. The post-test results found that MDA via text-chat and voice-chat could improve learners' speaking fluency much more than those with the traditional face-to-face dynamic assessment.

Similarly, a recent study by Ebadi and Bashir (2021) indicated the positive effects of MDA on learners' language development and also showed favorable results for those with text-chat tasks (but in improving writing skills). However, gauging the participants' perception, they seemed satisfied with the voice-based mediation in terms of opportunity, confidence, and improvement. The learners agreed that the voice from the teacher influenced learners' confidence when the teachers interacted with the learners through voice-based mediation, allowing the teachers to explain and to modify faster and more effectively than that through text-based mediation.

Although previous studies of MDA revealed the positive effects toward language skills of EFL learners, these favorable results cannot be assumed in other contexts, including Thai EFL contexts. In addition, an investigation of WhatsApp-based intervention in focusing on oral accuracy in using English proficiency is still limited in Thailand. MALL-based intervention has been claimed to provide positive results for language development among EFL learners but little is known about the application of MALL to Thai EFL contexts especially high school learners by using WhatsApp, a mobile application. As Chinnery (2006) called for the application of MALL in language learning due to the paucity of MALL research and implications to language learning, this study aimed to respond to this call by investigating the effectiveness of the application of a mobile application on speaking skills and this would fill the gap in a specific context of Thai EFL school education.

Method

Research Purpose and Questions

This article reported on the results as part of a larger quasi-experimental research project which aimed to investigate the effects of MALL-based intervention by using WhatsApp on Thai EFL learners' oral accuracy which refers to oral production without linguistic errors. The specific question was: Are there any significant differences of oral accuracy improvement between before and after provided mobile-based intervention of Thai EFL learners? How often are the teacher-student interactions via WhatsApp-based MDA in each oral task?

Participants

Eighty Thai male and female students, aged 17 and studying English as a foreign language in Grade 11 in an English course with the lower intermediate English proficiency level at a secondary school in southern Thailand, were invited to participate in the research project voluntarily. The participant criteria included owning a smartphone with an internet package. Therefore, a questionnaire was used to identify the eligible participants. Out of eighty students, through purposive sampling, thirty students with smartphones and internet packages joined the project voluntarily and were selected to be the participants of this study project.

Instruments

The instruments of this study were a questionnaire, oral tasks and oral pre- and post-tests. The questionnaire was employed to assess the smartphone ownership and the internet package of students and comprised seven questions aimed at gathering information on their daily use of mobile devices. During the treatment section, five oral tasks were utilized to develop oral speaking for five weeks during an English course. Students had three minutes to task by recording their voice and sent a clip, weekly, to the teacher via WhatsApp. To evaluate each students' speaking progress, an oral pre-test and oral post-test, which consisted of three tasks, were given to the participants twice: one before and the other one after completing five spoken activities via WhatsApp in order to evaluate the development of participants after receiving mobile-based intervention. To ensure the validity of the test, three experts in the English language field were asked to evaluate the test and give comments for the tool improvement. To ensure the reliability of the tests, a test of internal consistency reliability (Cronbach's alpha = .87) was conducted.

Data Collection

This study applied a mobile-based dynamic assessment (MDA) intervention boosting oral accuracy of Thai EFL learners' speaking. Before the data collection, this study followed the ethical guidance approved by the Center for Social and Behavioral Science Institutional Review Board, Prince of Songkla University, Thailand.

At the beginning of the project, the students were introduced and trained to use WhatsApp for necessary features in an orientation session. Then, they took an oral pre-test via WhatsApp. During the MALL based intervention for five weeks, the students completed the tasks via WhatsApp by recording their 3-minute voice clip each week outside of the class hours and sending it to the English native teacher. To analyze their responses before returning the feedback to learners via WhatsApp, the teacher used the scaffolding guidelines adopted from Poehner and Lantolf (2005), from most implicit to most explicit ones. These scaffolding steps are as follows:

Step 1: Teacher asks students to say again
Step 2: Repeat the whole phrase questioningly
Step 3: Repeat just the part of the sentence with the error
Step 4: Teacher points out that there is something wrong with the sentence
Step 5: Teacher points out the incorrect word
Step 6: Teacher asks either/or question
Step 7: Teacher identifies the correct answer
Step 8: Teacher explains why via WhatsApp

To facilitate learners' speaking with these scaffolding steps, the teacher provided information, recommendations, videos, and other resources via WhatsApp to support participants to improve their oral speaking during MALL based intervention process over the course of five weeks (see Figure 1). After the implementation of the MALL-based intervention for five weeks, the learners were assigned to do the oral post-test in order to evaluate their oral production.

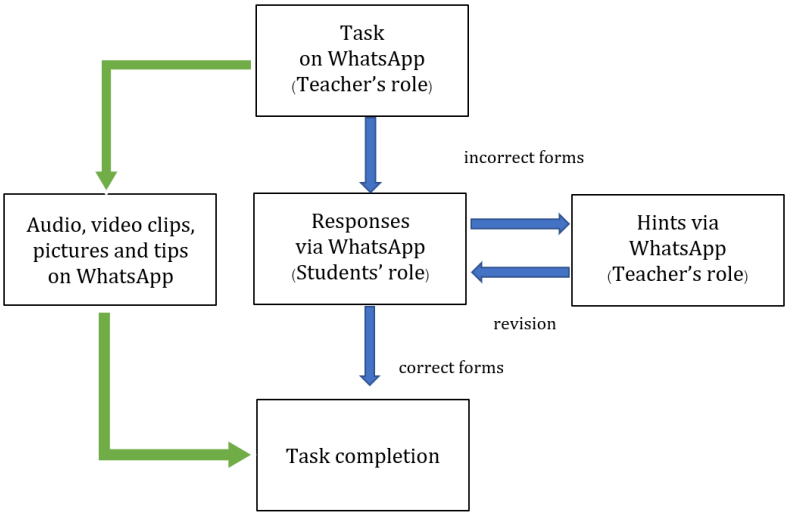

Figure 1. MALL-Based Intervention for Speaking Skills

Data Analysis

The scores from the pre- and post-tests which indicate oral accuracy, referring to how closely a learner follows the target language's rule structure (Bui & Skehan, 2018), were measured by calculating the number of error-free clauses as a percentage of the total number of clauses (Robinson, 2001; Skehan & Foster, 1997) based on the guidelines adapted from (Polio, 1997). The paired samples t-test was used to compare the scores from pre-test and post-test in order to analyze the relationship between the intervention and the learners' oral accuracy. In addition, the mean and standard deviation were used to measure the frequency of teacher-student responses via WhatsApp-based MDA in each task.

Results and Discussion

The research questions of the study aimed at investigating whether there was any significant effect of MDA on speaking of EFL learners after the intervention. The results were shown in Table 1.

Table 1. Test Performance (n=30)

Pretest		Posttest		Paired-Sample t-Test		
Mean	SD	Mean	SD	*t*	df	*p*
.48	.23	.74	.17	-7.03	29	.00*

Note. * $p < .01$

The results show that the mean score of all tasks from pre-test (M=.48) and post-test (M=.74) indicated the different improvement of their speaking significantly after the MDA intervention. In comparison of the results between the before and after treatment of MDA, a significant difference of the mean scores between the pre-test and post-test was found (p=0.00) at the significant level of .01, suggesting that the learners showed the development of oral accuracy after the treatment of MDA and this confirmed the effectiveness of MALL-based intervention for improving the learners' oral accuracy.

In addition, to understand the MDA-based interactions between the teacher and the students, the data of the frequency of the teacher-student responses on WhatsApp from the scaffolding steps in each task were calculated and the mean scores in each task also indicated the scaffolding process as shown in Table 2.

Table 2. Frequency of Teacher-student Responses in Each Task (n=30)

	Task 1	Task 2	Task 3	Task 4	Task 5	Overall
Mean	3.57	4.27	3.43	2.80	1.13	3.04
SD	2.82	2.68	2.62	2.78	1.92	1.52

The mean scores in Task 1 (M=3.57, SD=2.82), Task 2 (M=4.27, SD=2.68) and Task 3 (M=3.43, SD=2.62) were between 3.00 – 4.30, suggesting that the participants could complete these tasks after receiving scaffolding Step 3 (repeat just the part of the sentence with the error) and Step 4 (point out that there is something wrong with the sentence). However, the mean score in Task 4 (M=2.80, SD=2.78) seemed to be less frequent than the previous tasks. The participants had completed Task 4 with scaffolding Step 2 (repeat the whole phrase questioningly) and Step 3 (repeat just the part of the sentence with the error) from the teacher. For the last task, the mean score was the lowest (M=1.13, SD=1.92) of all. This may suggest the learners' development had less support from the teacher as an MKO because the participants completed Task 5 with scaffolding Step 1 (say again) and Step 2 (repeat the whole phrase questioningly). In addition, the mean score for overall tasks (M=3.04, SD= 1.52) presents that the participants mostly completed oral tasks with the scaffolding at Step 3 (repeat just the part of the sentence with the error).

This study investigated the effectiveness of MALL-based intervention on Thai EFL learners' oral accuracy. The results indicated that learners showed a significant development of oral accuracy after the MDA intervention. The results confirmed the positive effects of MALL-based intervention on English learning skills as reported by previous studies (Ashraf et al., 2016; Tarighat & Khodabakhsh, 2016; Rezaee et al., 2020).

The results in this study may be explained by the fact that the MDA intervention allows learners to interact, with the feedback of the teacher as an MKO, through the scaffolding process (Lantolf & Poehner, 2011), via their mobile devices. That facilitates learners with portability and connectivity beyond the boundaries of place and time. As Godwin (2021) asserted, using mobile technologies can be an accessible mediation between teachers and learners as a collaborative space, thus providing interactive learning resources for learners to enhance their oral accuracy. This practice is aligned with Thai EFL learners who have mobile phones to access in their everyday life, thus providing them with the learning space wherever and whenever they want (Miangah & Nezarat, 2012).

Moreover, through the MDA, teachers and learners can engage with speaking tasks to examine the learners' current level of performance on any task beyond the classroom wall. In the MDA process, the teacher could provide the feedback and suggestions with assistance that helps learners to identify their strengths and weaknesses in line with the notion of ZPD. The learners then could develop their learning through social interactions with the teacher to improve oral accuracy, indicating the possible collaborative space between the teacher and the learners via mobile devices (Godwin-Jones, 2011) and this is feasible in a Thai school context if the MDA intervention is

designed properly in a technology-enhanced learning environment as suggested by Sharma and Hannafin (2007). This study also could extend the study of Wongsuriya (2020) by using mobile applications to enhance young Thai learners' speaking, not only their pronunciation but also oral accuracy, suggesting that teachers are key to enhancing Thai young learners' English learning skills, especially oral accuracy.

Another explanation for the improvement of learners' language development in the results is the affordance features of MALL, the ability to access of MALL which allows learners to reach learning resources such as audios, videos, texts, and images on WhatsApp to enhance oral accuracy without limitation of time and place (Kukulska-Hulme & Traxler, 2007). As Miangah and Nezarat (2012) asserted, learning in a comfortable environment and scaffolding different levels of students are key factors in helping leaners succeed in learning language with MALL. In addition, the use of WhatsApp can facilitate language learning through multiple communication channels which could support corroborative learning (Godwin-Jones, 2011) as the mediation in interactions between learners and a teacher. The teacher can provide interactive feedback via WhatsApp to enhance oral accuracy and these interactions provide opportunities for using language in order to bridge the skill-gap of both learners and teachers as aligned with Godwin-Jones (2011).

In conclusion, the results of this study indicated that MALL-based intervention had a significant positive effect on developing oral accuracy of Thai EFL young leaners, filling the gap in a paucity of formal research in a Thai EFL context, providing empirical evidence that a MALL-based intervention can develop Thai EFL oral accuracy if designed appropriately.

Conclusion

The purpose of this study was to investigate the effectiveness of the MDA intervention on Thai EFL learners' oral accuracy via using WhatsApp. The results showed that using the MDA had a significant influence on enhancing the leaners' oral accuracy. These results also provide the important insights into how to maximize the use of available mobile devices to incorporate with classroom practices, in which today Thai EFL teachers face the online teaching practices with the school closure policy due to the Covid-19 pandemic and they are urged to integrate technology into their online teaching practices (Lao, 2020).

In this study, the MDA-based intervention illustrates its value to improve oral accuracy in a Thai EFL context. MDA, as a scaffolding processes, provides an opportunity for Thai EFL learners to practice speaking with interaction with the teacher through intervention. In order to improve learners' oral accuracy, the teacher can provide feedback in the form of scaffolding based on the ZPD of individual learners and WhatsApp as a mediator to be taken advantage of in MALL while supporting the process of DA. With the capability of WhatsApp, the teacher and students can interact in the peer collaboration and receive responses regardless of time and location.

This study sheds light on how to design the MALL-based intervention with a mobile device to scaffold EFL learners. However, one major drawback of this approach is the teacher's workload increases with a large class. Since many learners join the oral activities via WhatsApp at the same time, the teacher may need a longer time to

evaluate individual students' responses and this activity might reduce the promptness of their feedback. Moreover, limitations involving a stable internet connection in some local contexts should be noted for future preparation. Unsteady internet connections seem to cause learners problems uploading voice data when sending tasks with voice communication. Further work needs to be conducted to establish the effects of MALL-based intervention on other speaking skill aspects such as fluency, complexity, or the perceptions of EFL students after receiving the MALL-based intervention. Taken together, this study suggests that a MALL-based intervention should be a priority for Thai EFL teachers and policy makers to leverage the practical implication of everyday mobile devices in pedagogical practices for educational purposes.

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Systematic Literature Review on the Use of Metaverse in Education

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Systematic Literature Review on the Use of Metaverse in Education

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Abstract

Metaverse is a concept that has existed in our lives for years. However, it has become widely known by gaining new meanings thanks to the developments in blockchain and virtual reality technologies and the marketing techniques of social media companies. The aim of this study is to examine the studies on the use of Metaverse technology in education. In the study, it is also aimed to analyze the changing understanding of technology use in education over the years and to investigate the reflections of the concept of Metaverse on education. This systematic literature review is based on the reporting criteria of PRISMA 2020 (Page et al., 2021) and the scope of the study consists of 22 academic studies including the keyword "metaverse" and the keywords "education" or "teaching" or "learning" in academic studies scanned in Scopus, WoS, Eric and Proquest indexes. In this study, the distribution of the studies used in the metaverse in education by year, country, field, type of research, and the context of the technology used is included. In order to contribute to the research on the Metaverse in the field of education, it has been tried to determine the opportunities and risks that teaching in the Metaverse environment can offer to the field of education. In addition, it is thought that this study will shed a light on future studies.

Introduction

Computer and Internet technologies have an important role in daily life because they affect interpersonal interaction, communication and social behavior (Duman, 2008). Considering the fact that the developments in computer technology take place in our lives in stages, the first stage is the development of personal computers, second stage is introduction of the Internet, and the third stage is the development of mobile devices (Kamenov, 2021). Today, we are in the fourth stage where immersive environments created by digital reality technologies take place in our lives.

It can be clearly observed that the digital reality technologies have a potential to transform the field of education, remote working, marketing and economy fields and the entertainment industry, and have started to create a new information communication paradigm. It can be said that the new paradigm has emerged, which is shaped around the concept of Metaverse (Mystakidis, 2022). The word “metaverse” is formed by the combination of the words “meta” which means beyond or after, and the word “universe” (Cheng et al., 2022). Since metaverse consists of the combination of the words meaning beyond and universe, it also means beyond the universe. Metaverse can have different meanings for different disciplines or environments, but mainly it is a multi-user platform and

technological innovation, which is a digital reality environment beyond physical reality when it comes to computer technology or teaching technology.

Metaverse technology has a potential to attract interest of many in distance education by having the power to overcome the basic limitations of web-based, two-dimensional e-learning tools regarding reality and motivation (Collins, 2008). The use of information and communication technologies as fostering tools for learning processes based on emergent paradigms has become important in the transformation of students' learning (Demirer, 2013). Due to the fact that end users now could access technology more easily, technology integration along with changes in educational policies has become inevitable (Yang & Wu, 2012). With the influence of the constructivist approaches, the importance of using computer and Internet technologies in teaching environments is increasing (Çakır & Yıldırım, 2009). However, despite innovative practices and change in teaching paradigms based on advances in educational technologies, instructional methods remain unchanged and teaching process is revolving mainly around content transfer from textbooks (Friesen, 2017).

It is observed that major technology companies are in a competition to create the infrastructure and standards of Metaverse, continue to develop hardware and software for it, and deal with its privacy and security issues (Gadekallu et al., 2022). As a result of this competition, it is naturally expected such issues as the privacy rights of users must be protected, Metaverse will be inclusive for the education sector, and digital reality-based, ergonomic, comfortable and lighter hardware should be produced (Han et al., 2022). As Metaverse gains importance and interest especially in the field of distance learning, there is a need for research studies on examining the effects and practices of this subject area. Therefore, the aim of this study is to examine the studies on the use of Metaverse in the field of education, to determine the distribution of Metaverse studies regarding the year, country, field, type of research and the context of the technology used, and to shed on light for future studies accordingly.

Metaverse was first brought to the world scene in 1992 by Neal Stephenson 's science fiction novel named Snow Crash (Duan et al., 2021). Many efforts and research have been made to transform Metaverse technology from which does not actually exist but only based on a fiction book into a technology that can be used in real life (Kye et al., 2021). A research organization named as “The Acceleration Studies Foundation” (ASF) announced its Metaverse roadmap in 2006 including augmented reality, virtual worlds, mirror worlds, and lifelogging.

Ball (2022) describes Metaverse as a massively scaled and interoperable network of real-time rendered three-dimensional virtual worlds that can be simultaneously and permanently experienced by an unlimited number of users. Bosworth and Clegg (2021) states that metaverse is a series of sandboxes that you can create and explore with other people who are not in the same physical space. They defined the Metaverse within a frame where the perception of reality is created, the real-world merges with the virtual space and the reality is expanded into the virtual space.

Metaverse means a world in which virtual and reality interact and develop together throughout social, economic and cultural activities being carried out to create entities and values (Lee, 2021). Metaverse technology has started

to enter our lives quickly and some of its applications have begun to be used in education (Lee et al., 2022). For this reason, it is important to be able to determine the limits of the concept of Metaverse and the meanings of the concept of Metaverse from the very beginning to establish a solid foundation for the use of Metaverse in education.

In Metaverse applications, people will be able to use the Non Fungible Token (NFT) they produce, and share their virtual products, for instance, digital lands. Users will be able to create spaces for surfing, entertaining and learning on an interoperable platform and be a part of a global community (Hirsh-Pasek et al., 2022). The current and future usage of Internet services at 5G speed has created a great opportunity for the realization of experiences and applications on Metaverse platforms (Lee et al., 2021).

There are several Mertaverse platforms that were created up till now (e.g., Second Life, Open Simulator, Minecraft, Fortnite, Roblox, Sandbox, and Decentraland). These platforms are attracting many user day by day and the number of members is increasing accordingly. For example, Roblox has reached up to over 42 million active users, an increase of 19% since 2019 (Rospigliosi, 2022). As virtual reality platforms become easier to use and more interconnected, Metaverse platforms will promise further improvements in all areas. When virtual reality glasses and accessories acquire a more comfortable design appropriate for long-term use, it may become much more feasible to expand their usage areas and adapt them to educational environments.

It is quite significant to produce metaverse-based hardware and software products adaptable to teaching environments. Thus, it is important for educators, researchers, designers and developers to work together and guide each other on this issue. More specifically in terms of the adoption of new technological paradigms in education, Sarıtaş (2015) suggests that “educational institutions should develop a comprehensive strategy including curricula, professional development of teachers, educational philosophy, data security, legal and political issues, and transformation of resources and infrastructure to be able to address the many unique challenges that lie ahead” (p. 176).

Method

This study is a systematic literature review investigating the use of Metaverse in the field of education. Systematic literature review can be defined as a systematic, open and reproducible method for defining, evaluating and synthesizing the structure of the studies conducted (Fink, 2014). The research process was applied in accordance with the PRISMA 2020 checklist (Page et al., 2021). The PRISMA checklist is a guide sheet to prepare an organized reporting of systematic compilation, review and analysis studies in the international literature (Hür, 2021).

Data Sources

Databases were examined in the field of education for Metaverse. The existing literature was also taken into consideration in order to set up a basis for determining the keywords. The keyword "Metaverse" and the combination of the keywords such as "education" or "teaching" or "learning" were used to conduct this study.

Web of Science, Scopus, Eric and Proquest databases, which have high impact factors, were examined in accordance with the specified keywords. Due to the widespread use of the Metaverse environment in education in recent years, the study did not restrict the literature in years. Full text of the studies found in databases were evaluated and included in the systematic review based on inclusion and exclusion criteria as well as on their quality and relevance.

Quality and Conformity Assessment

Inclusion and exclusion criteria were established to assess the quality and relevance of studies in the literature (see Table 1).

Table 1. Inclusion and Exclusion Criteria

Inclusion Criteria	Exclusion Criteria
• Academic articles, Book chapters and books • Studies with the keyword “Metaverse” • Studies with the word “education” or “teaching” or “learning” • Full text studies • Public works • Studies published in English	• Whitepapers, online presentations, abstracts, and news • Studies not published in English • Non-full text works • Studies whose subject scope is not relevant enough to be examined

The literature review included full-text conference proceedings, journal articles published in high-impact indexes, books and book chapters. Technical reports, online presentations, news, and conference abstracts were not found suitable for review due to the lack of peer-review process. Although some studies (e.g., articles, books, conference papers) were found to have a keyword Metaverse, there was no relevant work within the scope of the notion of Metaverse. Hence, those studies not specifically addressing the Metaverse concept were not included in the review.

Results

Search Results

Studies containing the keyword "Metaverse" as well as at least one of the keywords "education", "learning" or "teaching" and those published in Scopus, Web of Science, Eric and Proquest databases were examined. 13 studies whose full texts could not be reached and four studies that were not in English were excluded from the scope of the review. Nine of the remaining 34 studies were also excluded because they were the same studies in different databases. Only one study was included in the evaluation from the repetitive recordings. After the conformity and quality evaluation on the remaining 30 studies, eight studies were excluded from the review, and a total of 22 studies were included in the systematic review.

Figure 1 shows the flowchart for the selection of studies included in the review.

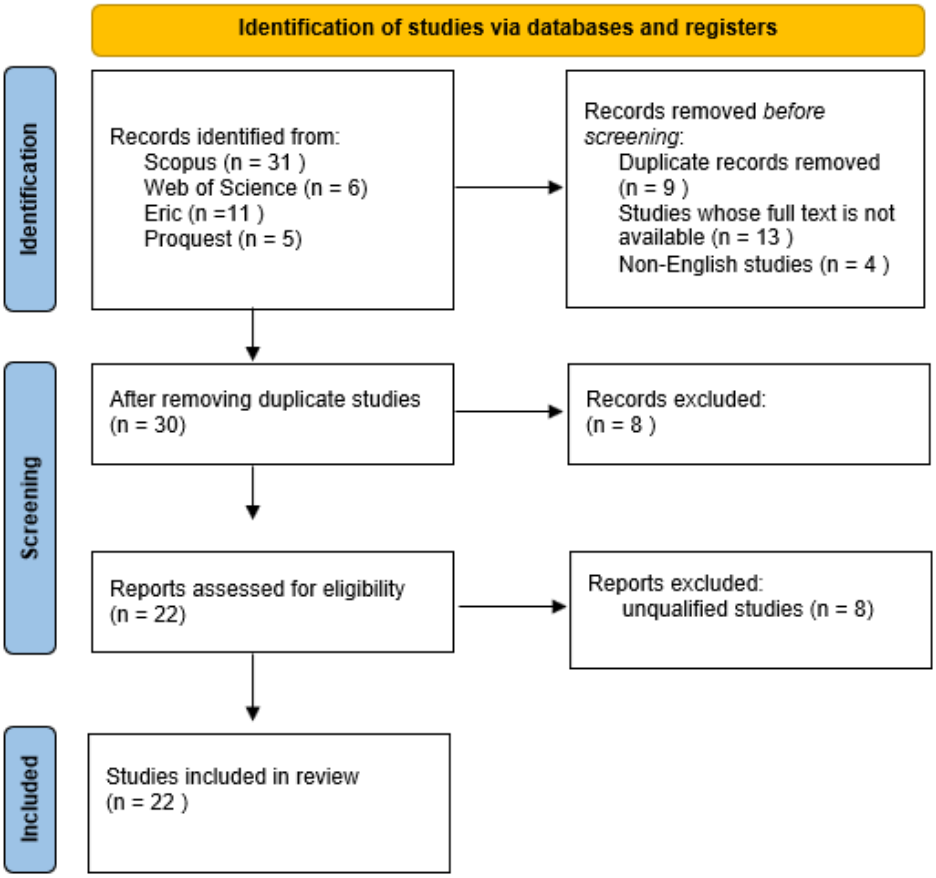

Figure 1. PRISMA 2020 Flow Chart

Features of the Studies

The year in which and *the country where the studies were conducted* were included in the review. Additional features such as *type of studies, the sample size (if any), the sample type (if any), the type of Metaverse technology used (if any), the objectives of the studies, the results of the studies,* and *the definition and technological context of Metaverse* were included in the review. First, title and abstract of all studies were examined and then the full text of those were evaluated in detail according to the inclusion and exclusion criteria. The characteristics of the reviewed studies (see Table 2), their goals (see Table 3), their findings (see Table 4), and the studies containing the definition and technological context of Metaverse (see Table 5) are given in the following sections.

Among the studies (n=22) included in this systematic literature review, there were 9 studies with students, academicians or adults in terms of sample diversity. The sample sizes in these studies ranged from 3 to 108. There was a total of 283 participants in 9 studies. Except for these 9 studies, 13 studies did not have any sample of individuals as they were only descriptive review studies. The largest number of studies (n=5) within the scope of the review that met the inclusion criteria were conducted in Japan. The most studies on Metaverse in the field of education (n=3) were done in the years of 2012 and 2022.

In addition, the number of studies in this field decreased after 2012 and increased again after 2020. By examining the types of studies according to their purposes, the largest number of studies (n=9) were found to be descriptive

studies. Considering the types of studies regarding the research methods, the largest number of studies (n=9) were found to conduct design-based research. It was found that the most studies were carried out at higher education level (n=10). The largest number of studies (n=6) was conducted with the participation of undergraduate students. On the other hand, there were seven studies which Metaverse platforms and tools were not used. The most common Metaverse technology (n=7) used in studies was 3D computer software (SecondLife). Table 2 below shows the characteristics of studies (i.e., country, year, research type, research method, education level of samples, and the technology used). The distributions of the features in the table are examined under the headings in the following section.

Table 2. Characteristics of Studies

Study Label	Country	Year	Research type	Research method	Education Level	Technology
S1	South Korea	2022	Exploratory	Literature review	Unspecified level	-
S2	Serbia	2022	Descriptive	Design-based research	Higher education	3D software
S3	South Korea	2022	Exploratory	Literature review	Unspecified level	-
S4	South Korea	2021	Descriptive	Design-based research	Unspecified level	Hololens
S5	South Korea	2021	Descriptive	Design-based research	Unspecified level	Hololens
S6	Japan	2020	Exploratory	Literature review	Unspecified level	-
S7	Colombia	2020	Explanatory	Mixed research	Higher education	3D software
S8	Singapore	2017	Exploratory	Literature review	Unspecified level	-
S9	Japan-United States (USA)	2015	Explanatory	Qualitative research	Higher education	3D software and Blink system
S10	Spain	2015	Descriptive	Design-based research	Higher education	3D software
S11	Japan	2014	Explanatory	Qualitative research	Primary education	3D software
S12	Colombia	2013	Explanatory	Qualitative research	Higher education	3D software
S13	Panama	2012	Descriptive	design-based research	Higher education	3D software
S14	China-USA	2012	Exploratory	Literature review	Unspecified level	-
S15	USA	2012	Explanatory	Mixed research	Adult learning	3D software
S16	Japan	2011	Descriptive	Design-based research	Higher education	3D software
S17	England	2010	Descriptive	Design-based research	Unspecified level	3D software
S18	Japan	2010	Descriptive	Design-based research	Higher education	3D software
S19	Japan	2009	Explanatory	Qualitative research	Higher education	3D software
S20	USA	2008	Exploratory	Literature review	Unspecified level	-
S21	US-UK	2006	Descriptive	Literature review	Unspecified level	-
S22	USA	2004	Exploratory	Design-based research	Higher education	projector, head tracking device

Distribution of Studies by Country

In terms of the distribution of studies by country, the findings showed that the country with the highest number of studies was Japan (see figure 2). Japan was followed by South Korea with four studies, the United States of America (USA) with three studies, and Colombia with two studies. One study was conducted in partnership with the USA and Japan, one study by the USA and the People's Republic of China together, and one study by the USA and the United Kingdom (UK) together. Only one study was found to be conducted in other countries mentioned above. Based on findings, two studies were carried out in South Korea, one in 2021 and the other in 2022. Moreover, studies in the USA and the People's Republic of China were carried out until 2012, no study after 2012 was found to be about Metaverse in education.

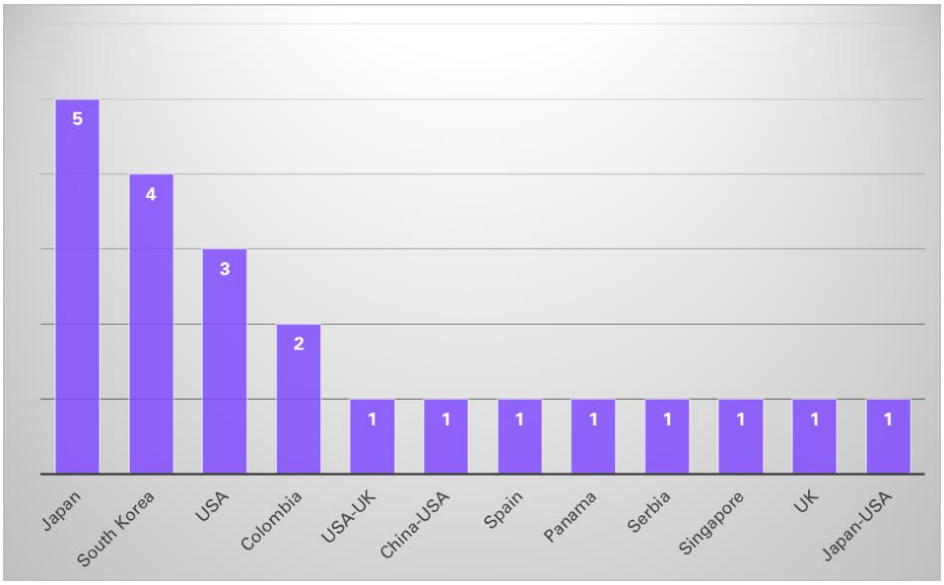

Figure 2. Distribution of Studies by Country

Distribution of Studies by Years

It is observed that the concept of Metaverse in the studies (from 2004 to 2022) has changed over the years from the perspectives of 3D computer software or digital reality. On the other hand, no studies were found in 2005, 2007, 2018 and 2019. It is seen that the largest number of studies (n=3) were done in both 2012 and 2022. It is also seen that the studies on Metaverse in education showed an increasing trend after the first years, then there was a decrease in the number of studies and an increase again in the recent years (see Figure 3). Among the studies examined, the concept of Metaverse in recent studies has tended to be perceived as based on either augmented reality or virtual reality technology. In previous years, the concept of Metaverse was handled in the form of places such as three-dimensional games and simulations. Moreover, it is observed that there has been an increase in the number of studies on Metaverse in recent years (Narin, 2021). The reason behind this is that big social media and technology companies such as Meta (formerly Facebook), Microsoft, Epic, Nvidia and Unity announced that they are investing in Metaverse and its components, which is seriously considered to be one of the technologies of the future along with the developments in virtual reality technologies (Dick, 2021).

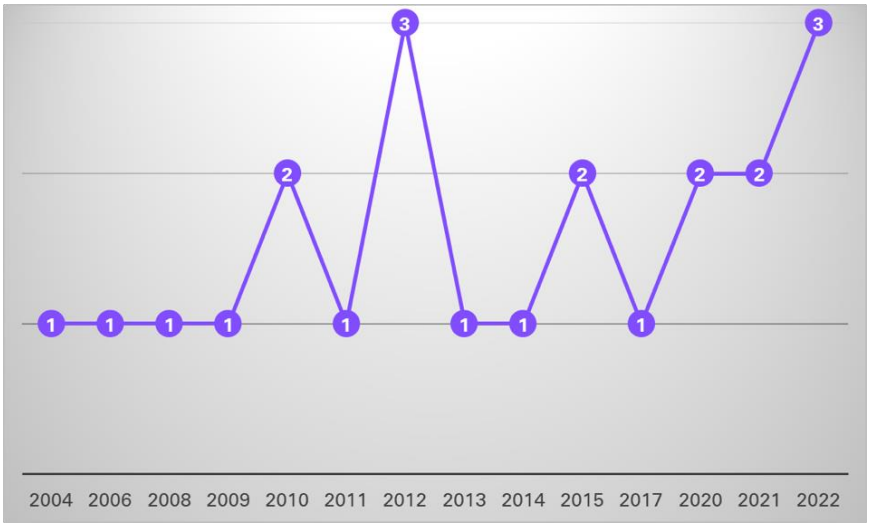

Figure 3. Distribution of Studies by Years

Distribution of Research Types According to the Purpose of the Studies

Research types of 22 studies were analyzed according to their purpose. Studies were categorized as exploratory, descriptive, and explanatory research studies according to their purpose. Exploratory research is a research that is conducted when the research topic is newly introduced to the field, provides preliminary information to the researcher, and is conducted to gather information at the most general level about a research problem (Saunders et al., 2012). This type of investigation is usually carried out when the problem is still in its infancy. It is often referred to as the theory-building approach or interpretive research, as it is used to answer questions such as what, why, and how (Saunders et al., 2012). Descriptive research is a type of research used to describe the characteristics of the sample. Descriptive research is a research that aims to obtain a description of the subject or activities of interest. Cause and effect relationship is not sought in descriptive studies, but some basic statistics can be used (Aggarwal & Ranganathan, 2019). Explanatory research is a method that deals with the identification of causes and effects through hypothesis testing and is developed to investigate a phenomenon that has not been studied or properly explained before. Explanatory research aims to find the cause of events by establishing cause-effect relationships (Swedberg, 2020).

Figure 4 below shows that approximately half (n=9) of the studies consisted of descriptive studies. Studies on Metaverse in education are those using basic statistics such as determining frequency and percentages, aiming to define the characteristics of the Metaverse environment rather than find a cause-effect relationship. Metaverse platforms are not easy to develop nor readily available for use in education. In a Metaverse platform, the environment should be designed in accordance with the purpose of the course as well as the needs of learners. However, instead of examining the effects of Metaverse environments on learners, teachers, and learning processs, it was preferred to examine the Metaverse environment itself. According to the Figure 4, the number of exploratory and explanatory studies were less than that of descriptive studies. The reason for this might be explanatory studies requiring a long process and a better planning, and more effort to test various dependent variables within the Metaverse platforms. When the distribution of exploratory studies by years was examined, it was observed that the number of these kind of studies increased in recent years. The reason for this would be the development of

digital reality technologies in recent years and the concept of Metaverse being perceived as a virtual reality-based platform rather than 3D computer programs. Therefore, definitions and explanations of Metaverse should be reconsidered and revised in the field.

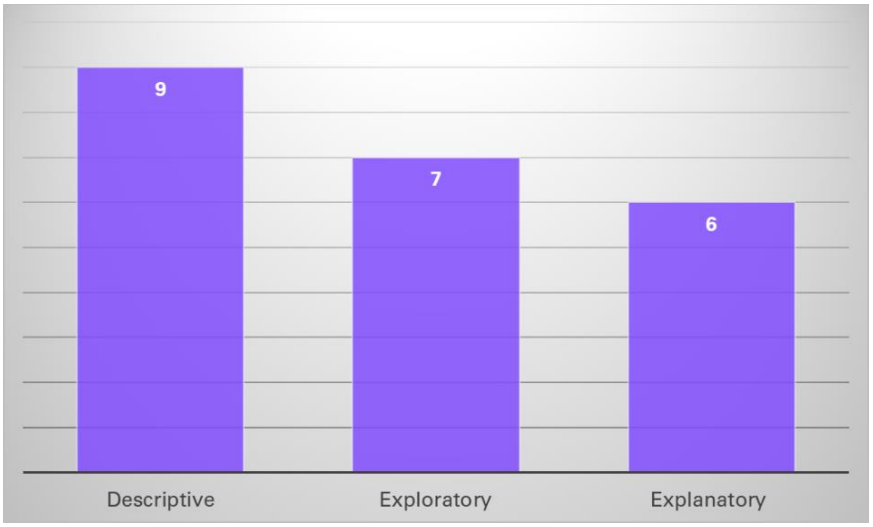

Figure 4. Distribution of Research Types According to the Purpose of the Studies

Distribution of Studies According to Research Methods

22 studies included in the study were examined according to their research methods. Studies were categorized as quantitative research, mixed research, design-based research and literature review. Among the studies examined, there was no study carried out using qualitative methods. It can be clearly seen that nearly half (n=9) of the studies included in the analysis were design-based research (see figure 5). Seven studies conducted literature review, four studies quantitative research, and two studies mixed research method.

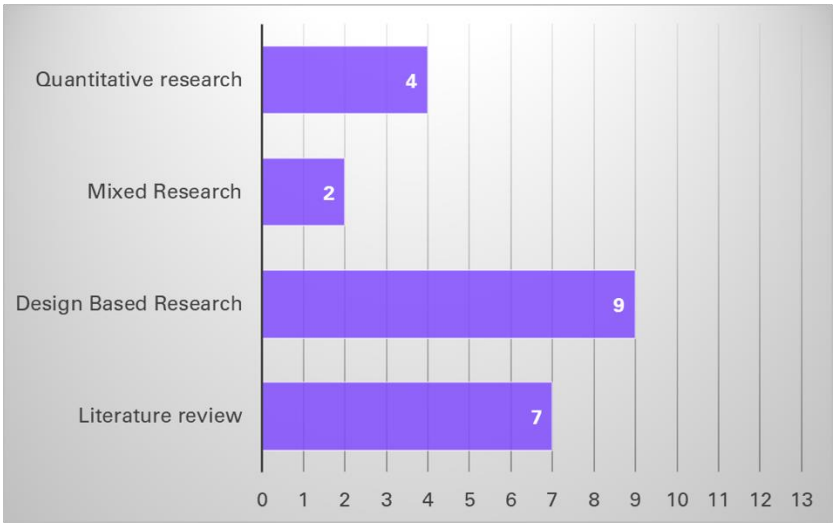

Figure 5. Distribution of Studies According to Research Methods

In design-based research studies, subject-specific teaching materials or environments were developed using 3D

computer software platforms such as Secondlife (see Figure 6). Descriptive studies in which the quality and effectiveness of the teaching environments were tried to be determined by collecting opinions of the participants.

Figure 6. Use of Second Life in Education (Kemp & Livindstone, 2006)

Distribution of Studies by Participants' Education Level

In 10 of the 22 studies included in the review, the education levels of the participants in the studies were not specified (see Figure 7). Most of these 10 studies (n=8) were literature review studies which did not focus on education level. On the other hand, most of the studies with education level (n=10) were studies conducted at higher education level. There was only one study at adult education level and one at primary education level.

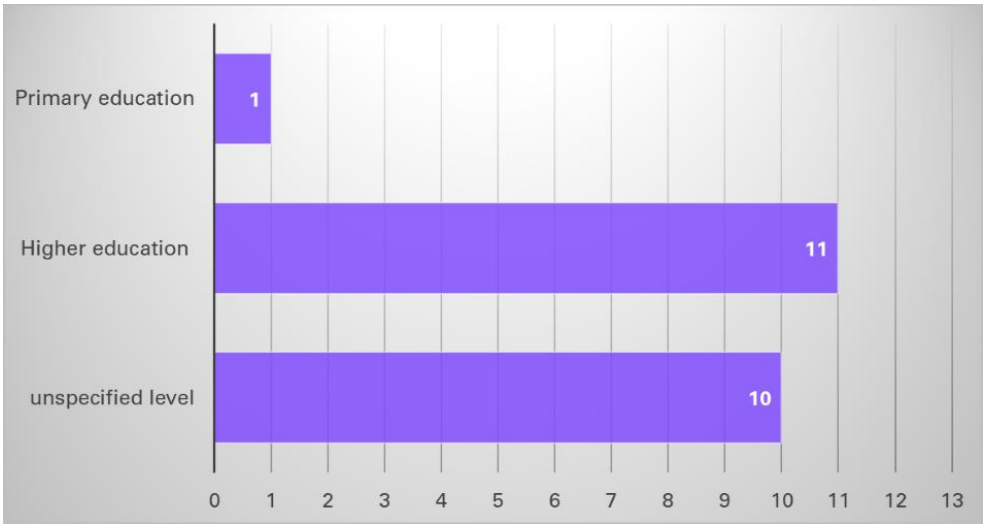

Figure 7. Distribution of Studies by Participants' Education Levels

Distribution of Studies by Sample Types

Different sample types were found to be in 22 studies included in this systematic review (see Figure 8). It is found

that six studies recruited undergraduate students, one study consisted of adults, one study included both undergraduate students and assistants, and one study consisted of primary school students. Participants were not included in design-based research and literature review studies (n=13). Accordingly, the studies in which the participants took part were the studies carried out at the higher education level with the highest number of undergraduate students.

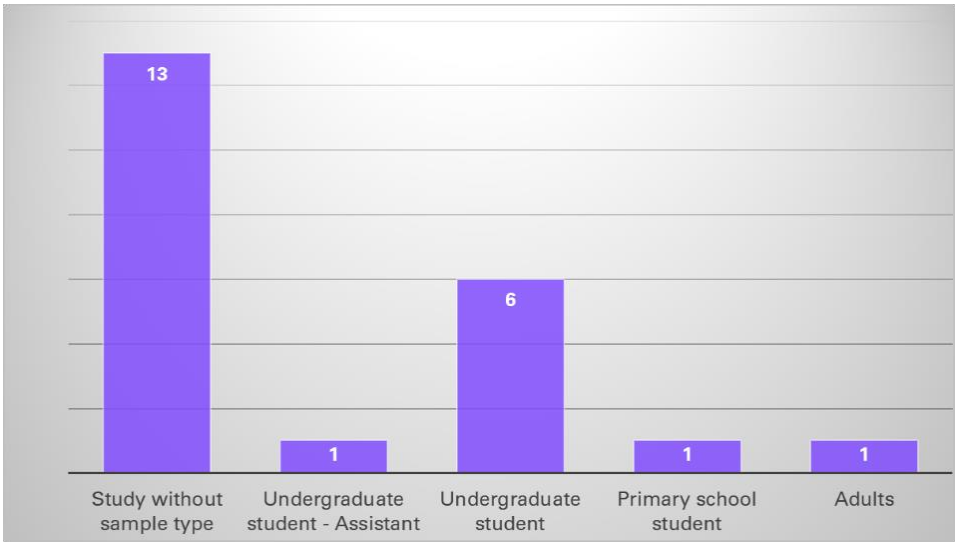

Figure 8. Distribution of Studies by Sample Types

Distribution of Studies by Technology Used

It is found that the most used Metaverse platform was a 3D computer software, that is, SecondLife (n=7). SecondLife was followed by the OpenSim platform, which is also a 3D computer software. It is seen that these software were included in studies conducted between 2009 and 2016. In addition, an unknown named 3D computer software was used in two studies.

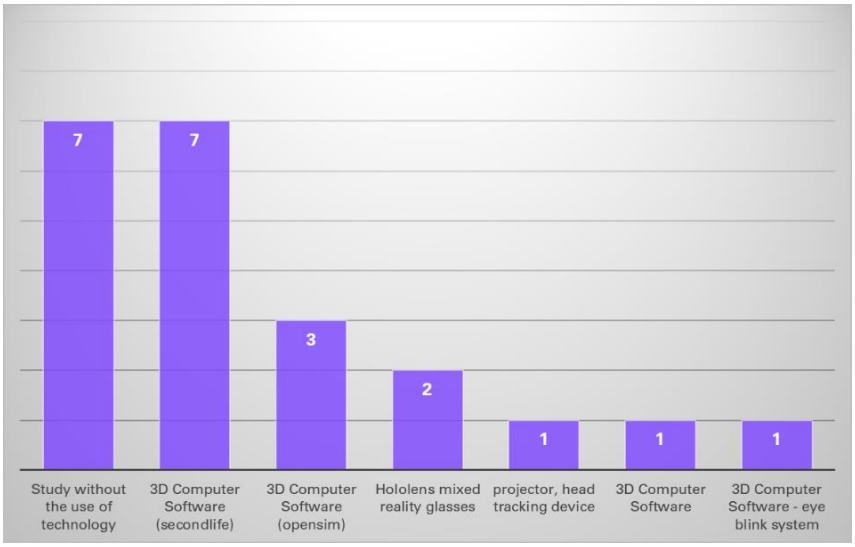

Figure 9. Distribution of Studies by Technology Used

Apart from these technologies, it is observed that there were two studies using mixed reality glasses, which we can consider them compatible with today's Metaverse understanding. These studies were different studies of the same authors using Microsoft Hololens (see Figure 10). Apart from this, there was a study using a projector and a head-tracker, which may be difficult to consider it as a Metaverse technology. Yet, since the technology, which was used in a study in 2015, was named as Metaverse by the authors, it was decided to include it among the studies examined.

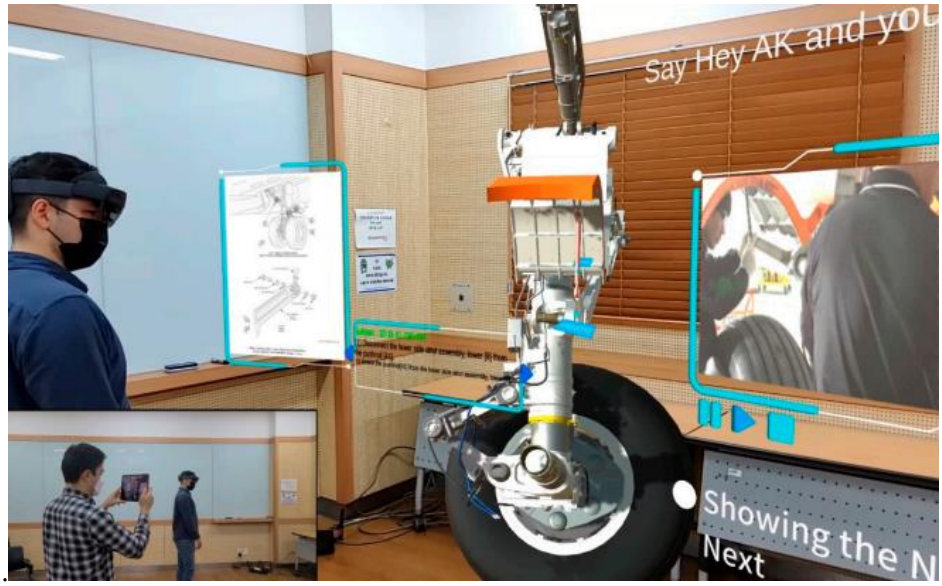

Figure 10. Use of Hololens in Education (Siyaev & Jo, 2021)

Objectives of the Studies Examined

The purpose of each study is different from each other based on different cases and situations. It was tried to determine how the concept of Metaverse was used in the field of education considering the technological context. In order to better understand the structures of the studies included in the systematic review, the objectives of the studies are presented in Table 3.

Table 3. Objectives of the Studies

Label of Study	Aim of the Study
S1	Develop a Metaverse world in which gamification can be maximized by providing a customized gaming experience.
S2	Create an educational experience in virtual worlds and overcome the limitations of pandemic situations.
S3	Explain the concepts, basic techniques, limitations, and guidelines for implementation needed to realize the Metaverse.
S4	Performing mixed reality training of aircraft maintenance for Boeing 737 on smart glasses developed with deep learning speech interaction module.

Label of Study	Aim of the Study
S5	Developing an aircraft maintenance training environment with speech recognition technology in Metaverse in addition to legacy manuals, 3D models and simulators.
S6	Analyze devices in virtual world, introduce current learning system, examine virtual learning systems, and propose concept for learning system in Metaverse.
S7	Metaverse acceptance level of students and teachers.
S8	Collaborative virtual and augmented reality environments.
S9	Virtual problem-based learning environment (Metaverse) on blink behavior.
S10	Facilitate the acquisition of French for tourism purposes through a virtual environment.
S11	Realizing the subject of radioactivity and nuclear safety with experiments and in the Metaverse environment and examining the effect of using Metaverse in STEM education.
S12	Explain the findings of implementing an English as a Second Language-based educational interaction through the use of Second Life.
S13	Metaverse as virtual learning environments and their applications in Electronics education.
S14	Examine the application of meta databases to support effective collaboration and knowledge sharing in virtual teams.
S15	Understand the relationship of trust development between meta database technology and its virtual members by examining how technology capabilities are used and modified to shape trust.
S16	To provide learning content for Japanese language and culture studies to international students in Japan and to understand the advantages and disadvantages of the Metaverse platform for foreign language and culture learning.
S17	Examining an excavation training simulation from an educational and technical point of view.
S18	determine the effectiveness of the use of problem-supported learning activities in the Metaverse.
S19	Examining how an anatomical eyeball as a three-dimensional learning material in Second Life can bring satisfaction and enjoyment to participants.
S20	To demonstrate that the educational uses of virtual worlds are already being explored and documented, and that academic research into virtual worlds is indeed of serious nature.
S21	To summarize the advantages and weaknesses of multi-user virtual environments for teaching and explore the possible benefits of integrating them closely with traditional Learning Management Systems.
S22	Provide visualization of the turbulent flow behavior of the flame and various combustion zones.

The aims of studies (S1, S3, S6, S8, S14, S20, S21) could be summarized as they aimed to explain the concepts, techniques and limitations of the Metaverse; to propose a concept for learning in Metaverse; to make comparisons with traditional teaching systems; to discuss the future of the Metaverse. The aims of the studies (S4, S5) in which metaverse technology was used based on digital reality are to perform aircraft maintenance training with mixed reality glasses, and to perform training in Metaverse environment with deep learning and speech recognition

technologies. The aims of design-based research studies (S2, S4, S5, S10, S13, S16, S17, S18, S22) were to create an educational experience in virtual worlds; to facilitate French and Japanese learning; and to provide mathematics education, electronics education, and excavation training on the Metaverse platform. The aims of quantitative research studies (S9, S11, S12, S19) were found to be examining the effect of teaching in the metaverse environment on blinking behavior, STEM education, English education and participants' satisfaction levels.

Results of Studies

The results of the studies included in the review vary according to the aims and problem situations of the studies. By examining the results of the studies, it is aimed to have an idea about the effectiveness of Metaverse, whether the use of Metaverse technology has the desired effect on the scrutinized variables. In addition, this study tried to determine the results of Metaverse technology and its contributions to the field of education (see Table 4).

Table 4. Results of Studies

Label of Study	Conclusion/results of the Study
S1	Gaming experience-based education should be actively considered in the Metaverse to avoid future problems with offline education. Providing a participatory educational experience focused on gaming, education using Metaverse can overcome the limitations of online education and create a sustainable learning environment.
S2	The use of metaverses in online learning can overcome limits during epidemics such as COVID-19.
S3	Important to interact as part of the story rather than seeing well- formed storytelling and immersive visual effects. Continued development of the brain-computer interface and Neuralink can translate into a form that gives an experience in the Metaverse that is difficult to distinguish from reality.
S4	Aircraft Maintenance Metaverse further enhanced aircraft maintenance training by providing intuitive and efficient control over the operation, and strengthened voice interaction in mixed reality smart glasses.
S5	The AI powered speech recognition system can be trained using synthesized data and can be used for industrial use with an average word error rate of 7.5% and overall accuracy of 94.7%.
S6	Metaverse integration should be provided to the education system in order to give the students a sense of vitality and reality necessary for maximizing the learning effect .
S7	It facilitates the use of pedagogies such as the flipped classroom and collaborative learning.It has been obtained that the level of acceptance of navigating and interacting in the virtual world is high. It facilitates the in-class and out-of-class education process synchronously and asynchronously. It should be scalable. Some technological and pedagogical challenges have been identified that need to be considered when implementing a virtual world.
S8	A mix of real and virtual teaching opportunities may be more effective. For those who are not comfortable using online 3D environments, training in shared sandboxes

Label of Study	Conclusion/results of the Study
	should be optional. The overhead of time required to implement VR-based Metaverse can become prohibitive for problems that require quick and efficient solutions. Modalities, such as the ability to touch scenes as if they were real 3D scenes, could increase the dimensions of electronic education in cyberspace.
S9	Students enjoyed the lesson. The difficulty of the problems is related to the number of blinks of the students. It has been determined that when teachers use the blink system, they can evaluate students' attitudes to achieve higher results in a virtual lesson.
S10	There are a few technical problems mostly related to bandwidth and servers, as well as limitations imposed by the platform that prevent their use. Virtual worlds support collaboration, fun, and learning as they are areas that require constant negotiation between avatars. Feeling that they actively participated in the activities motivated the participants.
S11	The students clearly enjoyed the virtual lesson.
S12	The students fully understood the subject taught in the virtual classroom.
S13	Experiments and the Metaverse environment can be effective in teaching.
S14	The Second Life platform has a very similar level of effectiveness to the traditional classroom teaching method for successful second language practice.
S15	On the Second Life platform, the attendance rate is higher than the traditional course.
S16	A virtual world application with interesting features such as being flexible, adaptable, accessible and based on free software for e-learning support allows to perform all kinds of simulations, signal analysis and other activities as in a complete ICT laboratory.
S17	Real-life hand movements are reflected on the platform late.
S18	Metaverse technologies provide capabilities for shared media and processing, the interaction and continued use of these capabilities impacts people.
S19	Metaverse technologies provide capabilities for communication, team process, and interaction, the interaction and continued use of these capabilities impacts people.
S20	Metaverse technologies provide capabilities for shared media, communication, team process, and interaction, the interaction and continued use of these capabilities impact people.
S21	The Secondlife platform positively affects the reliability of individuals and institutions.
S22	Individual reliability and trust; Awareness is positively impacted by the use of certain VWTCs such as communication, interaction, creation and team process.

The results of studies (S2, S3, S8) which make inferences about the future of Metaverse were as follows: Metaverse platforms are expected to be used in order to complement the deficiencies in online learning environments; it is expected that digital reality-based Metaverse technology will reach a level that cannot be distinguished from reality by the help of the development of brain-computer interfaces and the provision of

additional features such as the sense of touch. The results of such studies as S1, S3, S5, S6, S7, S8, S11, S21, S22 made suggestions for further development of Metaverse technology in teaching environments that can be listed as follows: active learning environments based on experimental learning and gamification should be created; storytelling should be given importance rather than visual effects; real life elements should not be ignored; features such as scalable Metaverse technology and speech detection should be used together with artificial intelligence technology; and students' learning should be supported with pedagogy and content knowledge. The studies labeled as S7, S8, S10, S13 reached conclusions about the disadvantages of using Metaverse in educational environments. They stated such disadvantages as technological difficulties related to bandwidth and servers during the use of Metaverse; extra time or work required to design and develop a Metaverse environment in which learning and teaching process will take place; limitations and restrictions of Metaverse platforms may prevent the desired teaching practice; and real-life movements may be reflected on the Metaverse platform too late.

This review study found that all studies reached conclusions about the beneficial aspects of using Metaverse in educational settings. According to these results:

- A participatory and sustainable learning environment could be created
- The efficiency of the learning process can be maximized with Metaverse.
- Metaverse can facilitate the use of synchronous and asynchronous learning, as well as methods such as flipped classroom and cooperative learning.
- Metaverse can be used for fun learning to provide motivation and cooperation.
- Metaverse can be used to ensure students' attendance.
- Metaverse contributes to the development of trust building, awareness raising, communication skills, interaction, product creation and team management processes.

Metaverse and its Technological Context in Studies

In the studies included in the systematic review, Metaverse technology appears in two different contexts, namely, three-dimensional computer software-based Metaverse platforms and digital reality-based Metaverse platforms (see Table 5). Some studies (S1, S2, S8) used the concept of Metaverse in a single way, even though they deal with it in both contexts above. Table 5 below summarizes the definition of the concept of Metaverse and the context of Metaverse technology (3D software-based or digital reality-based). The definition of Metaverse in the studies examined and how it is perceived based on these definitions was also examined. According to Table 5, it can be seen that many different definitions of the Metaverse were made. Within these definitions, Metaverse was mentioned as a virtual world, a virtual environment or a virtual space (S1, S3, S4, S5, S7, S8, S9, S10, S11, S14, S15, S16, S18, S19, S20) and a three-dimensional world (S4, S5, S16, S20, S21). It is seen that there are studies (S2, S4, S5, S6, S7, S9, S10, S16, S19) that refer to the metaverse as a mixed reality world or talk about the avatar feature of a human being with a digital twin. Definitions in many studies (S2, S4, S5, S7, S12, S13, S14, S15, S16, S19, S20) emphasized the interaction feature of the Metaverse. Additionally, definitions in some studies (S12, S14, S15, S19, S22) mentioned that Metaverse is scalable, a new type of Internet, a simulation software, and has no physical limitations, aims to simulate the real world. Based on these definitions, Metaverse perceived

today as they are virtual worlds in which people exist and interact through their avatars, created by computers connected by blockchain technology, and also powered by digital reality technologies.

Table 5. Metaverse Definition and Technological Context in Examined Studies

Label of Study	**Metaverse Definition and Technological Context**
S1	"A gaming platform where users create their own virtual playgrounds by customizing the virtual world." (3D software based) (Digital reality based)"
S2	"Simulation space based on interaction with a computer, inhabited by several users, represented by iconic images called avatars, able to communicate with each other in a synchronized manner." (3D software based) (Digital reality based)
S3	"A virtual world based on everyday life where both real and unreal coexist." (Digital reality based)
S4	"The mixed reality world within the physical world, where users come together and interact in a 3D virtual environment." (Digital reality based)
S5	"The mixed reality world within the physical world, where users come together and interact in a 3D virtual environment." (Digital reality based)
S6	Three-dimensional computer environments where users exist with their avatars." (3D software based)
S7	Digital structures in which participants interact through avatars, with which they try to reproduce real life in a virtual metaphoric environment without space-time constraints." (3D software based)
S8	"Parallel worlds existing in virtual spaces powered by interconnected computers." (3D software based) (Digital reality based)
S9	"A virtual three-dimensional world where avatars do everything for us." (3D software based)
S10	" An interface program that allows the user to connect to the virtual world through an avatar and create the world he needs to achieve the goal." (3D software based)
S11	"Virtual 3D World." (3D software based)
S12	Simulated areas of social interaction on the web that aim to mimic the real world geographically, sociographically, economically and communicatively, but overcome the

Label of Study	Metaverse Definition and Technological Context
	limitations of the real physical world." (3D software based)
S13	"A computer-generated world where people can share and interact as if they were in the real world." (3D software based)
S14	"Three-dimensional virtual environments that allow people to interact with each other through software tools without physical limitations." (3D software based)
S15	"Three-dimensional virtual worlds where people interact with each other and their environment using the metaphor of the real world, but without physical limitations." (3D software based)
S16	"3D digital environment where one can navigate and interact with other avatars in a virtual space created by electronic objects with a user-agent avatar to create online campuses, virtual museums, academic conferences." (3D software based)
S17	"A relatively new type of Internet application, similar to 3D games, different from the Internet in that its demands on host systems and network traffic are more bandwidth intensive." (3D software based)
S18	"World-class three-dimensional virtual space services that can offer complementary activities between face-to-face learning and e-learning, with state-of-the-art technology that can be used for experiential education." (3D software based)
S19	"It is not only a cyberspace with a space simulator, but also a virtual world where there are social activities, where the computer user can interact with other users through their own representation of avatars." (3D software based)
S20	"Going beyond the vision of an immersive 3D virtual world, networks that create and interact with physical world objects, actors, interfaces, and virtual environments." (3D software based)
S21	"A permanent 3D world like SecondLife." (3D software based)
S22	"In addition to developing self-configuring, scalable visual displays, a digital technology that enables learning and teaching in an inclusive, non-restrictive environment powered by commodity hardware." (3D software based) (Digital reality based)

Conclusion and Discussion

The concept of Metaverse and the technology it expresses have been used in different formats and platforms for years. To observe the change in the concept of metaverse over the years, a need has arisen to conduct a systematic literature review. There are many studies on Metaverse when it is examined regardless of any discipline and field. There is a need for in-depth analysis to determine how each of these studies deal with the Metaverse. For this reason, in this study, the subject of Metaverse was examined by limiting it to the field of education. The first conclusion reached in this review is that research on the Metaverse continues not only in recent years, but also in the past ten years and even before. After an in-depth examination of the studies, it was observed that there were changes in the way the concept of Metaverse was handled. In the first studies on Metaverse in education, the concept was discussed in the context of three-dimensional software, while in later studies, the concept of Metaverse began to be discussed in the context of digital reality technologies. The reason why the concept has become popular in recent years is that it connects with already popular augmented reality and virtual reality technologies, which give a feeling of immersion. Major social media and technology companies continue to invest in digital reality technologies. With the development of blockchain technology, since it has the potential to provide the concept of metaverse with a completely different position, studies in this field have gained a vast interest and importance.

Looking at the findings in the distribution of the studies examined by countries, it is difficult to say that there is a certain pattern. There are more studies in technologically developed countries such as Japan, South Korea and the USA. The fact that Metaverse technology, which has a relatively high cost and requires users to have high technology literacy, is easier to access in developed countries can be interpreted as a reason for this situation.

The findings in the distribution of the studies examined by years showed a certain pattern. While the highest number of studies were found in 2012, the number of studies decreased later reached the same level again in 2022. The concept of Metaverse has changed in this 10-year period. Wheras the studies conducted in 2012 were three-dimensional software-based Metaverse studies, the studies in 2022 were digital reality-based Metaverse studies. Today, when Metaverse is mentioned, virtual reality glasses and digital reality-based games come to mind. This is important in terms of having an opinion on the speed of technology development and how it affects our lives in a 10-year period.

Considering the findings in the distribution of research types according to the purpose of the studies examined, the result shows that most of the studies were descriptive studies, and all of the descriptive studies were design-based research studies. Experimental methods were not preferred in design-based studies, or applications whose effects on a dependent variable were not carried out. In design-based research studies, mostly three-dimensional computer software-based software has been developed on Metaverse platforms. For the descriptive studies conducted in recent years, there are studies carried out using mixed reality glasses. This situation can be interpreted as the understanding the concept of Metaverse has evolved and the developments in technology have been kept up, and digital reality-based Metaverse technologies have begun to be used in education instead of three-dimensional software-based Metaverse. Additionally, since digital reality-based Metaverse technologies have just

begun to be developed in education, research is mostly carried out in the form of design-based research. When these designs take a certain shape, it can be expected that there will be an increase in the number of studies which the effects of various dependent variables are examined in.

Considering the findings in the distribution of the studies examined according to their research method, it was observed that most of the studies were conducted in the design-based research type. For some of the design-based studies, it was observed that data were collected from the participants through interviews and questionnaires, and numerical data such as frequency or percentage were used. However, these studies do not fully cover the statistical and methodological processes applied for quantitative research methods. For this reason, since the method used in the studies cannot be considered as a quantitative or a qualitative research method, studies involving designs developed on Metaverse platforms were examined under the design-based research type. In most of the studies carried out with the design-based research method, the design was developed on three-dimensional software-based Metaverse platforms. Platforms such as Second Life are open source and open to developing different Metaverse environments specific to each course, topic or participants.

When the distribution of the studies according to the education level of the participants was examined, it was observed that most of the studies were carried out at higher education level, except for the studies in the literature review type. This may be because of the fact that researchers prefer purposive sampling in their studies. Considering the findings in the distribution of the studies examined according to the sample type, mostly undergraduate students were included in the studies, since most of the studies were conducted at the higher education institutions.

Considering the findings in the distribution of the studies examined according to the type of technology used, the Second Life platform was used in the highest number of studies, except for the literature review type studies. Today, there are limited number of studies using digital reality-based Metaverse technology that comes to mind when Metaverse is mentioned. The reasons would be that the expected ergonomic developments in augmented and virtual reality technology are not at the desired level, and these devices are not yet affordable for a large number of end users, and the software development process suitable for devices is yet new and not widespread in order to conduct research on this subject. However, due to the recent entrepreneurship and attempts of technology companies in virtual/augmented reality devices and software marketing, the Metaverse technology is now more capable than ever before of changing our lives, which we believe it will be witnessed and observed in the following years.

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Strategies to Address Cheating in Online Exams

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Strategies to Address Cheating in Online Exams

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Abstract

This is a descriptive study to investigate one of the most critical issues faced by teachers in evaluating their students' performance at the university level during COVID-19. It aimed to specify the exams' problems faced by the Jordanian universities' teaching staff members, and the strategies they used to face cheating by their students in online exams. The researchers built a questionnaire of 33 items under (3) main headings, and sent by email to a random sample of 120 out of 995 teaching staff members in two Jordanian universities, University of Jordan and Arab Open University/ Jordan, in the academic year 2020/2021. The study revealed that most of the staff members faced a number of problems, especially with the effort needed for the preparation of online exams, and the advanced ways of cheating being used by their students. It also showed that they used several strategies to face those problems such as open-ended questions to assess knowledge achievement, and project application to assess students' skills, as well as using cameras to control exams monitoring.

Introduction

It is needless to say that CORONA pandemic presented a package of unprecedented challenges to the entire educational system. E-education has become a reality in schools and universities all over the world, and digital technology has undoubtedly provided advanced multimedia and communication devices that have profoundly contributed to these challenges. In the absence of clear educational policies in most institutions, decision makers have faced significant challenges in managing the educational process remotely (Zhang et al., 2020). Abduh (2021) also confirmed that challenges faced during COVID-19 have forced education systems to look for innovative strategies and techniques as well as effective and non-traditional teaching methods. This has obviously encouraged students to deal with modern educational tools with virtual learning environments (Chrtistano, 2020). Thus, attention has turned to the use of educational platforms for various stages, especially after they proved effective communication during the pandemic (Bilen & Matros, 2021).

Students' evaluation is one of the important components of the educational process. That is why development of educational systems has always been accompanied with a development in the evaluation methods, and the most important challenge that has emerged all over the world is how to use cross-platform examinations to evaluate what students have learned (Cuadrado-García et al., 2010). The world has therefore turned to e-evaluation which utilize information networks, software and multimedia applications to provide evaluation tools that help teachers measure students' achievement through diverse quantitative and qualitative data (Bahar & Asil, 2018).

Although electronic evaluation is often based on the same philosophical basis as the traditional evaluation in terms of its application of educational theories, it requires automating the evaluation process with a comprehensive reliance on online learning in virtual environments (Rolim & Isaias, 2019). The evaluation process has begun with a broad shift from its traditional paper and pen to the electronic style of evaluation that allows the use of text, image, audio, video and interactive virtual environments, because it is the effective entry point for the development of education, improving its quality and effectiveness and improving its efficiency under the circumstances imposed by the pandemic. This is the basis of educational development and the most important element of the educational system (Bahar & Asil, 2018).

It might be necessary here to point out the changes in evaluation patterns over time, as the traditional evaluation has often been based on direct questions targeting lower thinking skills by memorizing information, while the diversity of electronic evaluation expands using higher understanding and thinking skills such as analysis, problem solving and high performance that need performance-based evaluation to assess students' achievement (Appiah & Van Tonder, 2018). This led to using projects as evaluation tools and displaying direct audio and image communication using a front and rear camera that clearly show the student and his surroundings (Guangul et al., 2020). In addition, new formats have been developed in the electronic evaluation that fit this type of evaluation as a time strategy, as questions that should be answered in a short time, allowing students to call more information to their memory (Appiah & Van Tonder, 2018).

Electronic evaluation does not only mean multiple choice questions. It allows evaluating students through simulation programs, wiki sharing sites, blogs, self-reviews, peer reviews, and open-answers questions, which measure higher levels of cognitive abilities and practical skills in terms of using problem-solving methods, critical thinking, creative thinking and decision-making. Students may make presentations on specific terms requiring peer excellence and diversification in cognitive and skilled activities using computer and Internet technologies (Gamage et al., 2020). Although academic cheating is not new, online learning has widened the phenomenon to be a globally growing one that electronic evaluation is facing many problems with, the most important of which is the reliability, credibility and accuracy of electronic evaluation (Kharbat & Daabes, 2021; Kearns, 2012). The Corona crisis globally contributed to the high rate of cheating due to the lack of direct control over students during the examinations, increasing its prevalence and negatively affecting the integrity and credibility of the learning process and its results (Awdry & Ives, 2020). Technological developments have undoubtedly contributed to the diversity of electronic cheating methods some of which are in the form of groups through social media, each of its members solves a part of an exam, and then shares the answers with the others. Students may also navigate the web and get answers through search engines or specialized websites. As the world of information scarcity moves from a world of abundant information, it has become difficult for faculty members to assess whether students' work is their own or from other sources such as books and research or by paid teachers or elder students (Gamage et al., 2020). Hollis (2018) previously revealed that there is an expanded industry that provides specialized services under the supervision of specialized teachers to answer test questions, worksheets and so on.

Sajer et al. (2012) called educators and decision makers to strengthen ways to reduce electronic cheating, build the learner's personality on virtue and self-esteem, revive morality and grow self-control among students by

developing and raising the inner conscience from a young age and enhancing trust in parents to contribute to reducing cheating. On the other hand, online education requires moving towards alternatives to the traditional evaluation if we are to be effective (Al-Anazi, 2021), diversifying alternative evaluation forms, giving challenging duties, adopting strategies that uniquely teach students, and communicating through discussion forums with students to learn about their ideas, inclinations, interests and behavior, which contributes to the development of their skills and ability to solve their life problems(Gamage et al., 2020). Hussein et al. (2020) noted the need for tools and monitoring mechanisms, including direct monitoring when a human observer is available, data transfer encryption, recorded review, automated surveillance, browser closure features, computer operation closures, key press alerts, facial identification tester options, image comparison, 360-degree webcam features and camera mobility. In the same context, Artificial Intelligence (AI) systems have been used to monitor students, allowing analysis of their movements and environment and determining whether potential cheating behavior would be possible (Kharbat & Daabes, 2021).

A related software used in Australia is e-proctor, which is used for electronic protection, or so-called online surveillance through the use of AI applications, in which students' movements are analyzed with access to students' computer microphones and webcams. Malaysia used surveillance with a 360-degree motion camera to detect students' workspaces to ensure that there were no unauthorized materials (Cerimagic & Hasan, 2019). In Korea, students are required to maintain voice and visual contact with observers at all times, and must first verify their identity by employing several techniques to verify the identity of the person conducting an online exam, a strategy of three steps that were used on 86 students; the first was to ask student to send a signed moral pledge, the second was to track the movement of the face through a software when holding the exam, and the third was when the student session was to be identified by a camera while having random questions (Lee et al., 2020). In Singapore, personal verification techniques were used through voice, image and clicks on the computer keyboard (González-González et al., 2020; Kharbat & Daabes, 2021).

Despite previously mentioned strategies and techniques to face electronic cheating, the problem still faces the integrity and credibility of the electronic evaluation. While some faculty members prefer electronic exams over traditional methods for students' evaluation (Adebayo & Abdulhamid, 2010; Adegbija et al., 2012), others resist the idea because they believe that electronic evaluation is not fair (Dwivedi et al., 2012; Kuikka et al., 2014). This prompted the researchers to conduct this study in order to look into this phenomenon and how faculty members at Jordanian universities face it, and how they see the ways to reduce it.

The Corona pandemic has pushed educational institutions into an e-learning space and expanded the use of online education. By the end of 2020, there were many queries in the minds of both students and teachers, most of them about assessment and evaluation mechanism. States issued decisions commensurate with their respective circumstances by adopting online education in different forms with regard to e-evaluation (Huber & Helm, 2020; Gamage et al., 2020). These decisions have caused concern among institutions' staff members about the integrity and credibility of electronic evaluation. In order to find out the facts about cheating in the electronic evaluation issue, we read the UNESCO Report (United Nations Educational, Scientific and Cultural Organization [UNESCO] (2020), which confirms that faculty members are not convinced of the results of students' tests when

switching to online education, due to electronic cheating. A survey of faculty members in the United States of America, 93% predicted that online learning would be more vulnerable to academic deception. Other studies also have shown high rates of electronic cheating (Adzima, 2020).

Jordan is not isolated from global concern about the credibility of electronic evaluation, as the pandemic caused successive decisions on the mechanism and form of exams at different levels and disciplines of education (Ministry of Higher Education and Scientific Research, 2020a), reflecting the confusion caused by the pandemic. Local newspapers and media referred to unrealistic results, as they called them, obtained by a number of students and questioned the results of national exams (Mazher, 2021), and that a new type of cheating has emerged called "electronic cheating" through the use of smart applications as social media, thereby reducing the credibility, reliability and accuracy of exams' results (Kiswani & Sabi, 2020). Along their direct experience at the university level, the researchers have witnessed a number of problems related to this vital issue. These indicators underscore the need to provide sufficient data on the phenomenon of electronic cheating and ways to reduce it, particularly in Jordanian universities, to help the planners and educational decision-makers to accurately formulate policies that contribute to the integrity of academic evaluation which requires an in-depth study of this issue on precise and clear methodological bases.

Method

This is a descriptive study which aimed at collecting and analyzing data on the real situation of the problem being studied.

Questions of the Study

To achieve the objectives of the study, the researchers stated the following questions:

- What strategies have the faculty members at Jordanian universities tried to reduce electronic cheating?
- What problems have the faculty members faced in implementing these strategies?
- Are there statistically significant differences at the level ($\alpha \leq 0.05$) in the overall average degree of strategies used among the faculty members at Jordanian universities and the problems they faced due to gender?
- Are there statistically significant differences at the level ($\alpha \leq 0.05$) in the overall average degree of strategies used among the faculty members at Jordanian universities and the problems they faced due to their teaching experience?
- What are the faculty members' proposals to reduce electronic cheating**?**

Importance of the Study

- It may reveal the use of certain strategies to reduce electronic cheating that can be adopted or developed by faculty members at other universities.
- It may contribute to enriching research in other countries on the phenomena of electronic cheating and

how to reduce it.

- Decision makers in Arab and foreign universities may help develop their strategies to reduce this phenomenon.

Limitations of the Study

- The study was conducted in summer semester of 2020-2021 school year.
- It is limited to identifying strategies to use electronic technologies to reduce cheating during the CORONA pandemic and problems faced in this respect.
- It is limited to the faculty members at the two universities chosen for the study.
- The results of this study were determined by the reliability of the tool used by the researchers and also by the sincerity and objectivity of the respondents. They can only be circulated to the community from which the sample of the study was taken.

Procedural Definitions

Electronic cheating: A type of cheating done by using modern technology through the use of smartphone applications including WhatsApp and Team Viewer ... etc., which falsifies the performance of the learner and weakens the credibility of electronic evaluation.

Strategies to reduce electronic cheating: Techniques and procedures by the faculty members in the two universities to reduce electronic cheating.

Study Community and Sample

The study community consists of 995 faculty members of the Technical Tafila University, and Princess Sumaya University in the Jordanian capital, Amman, in the 2020/2021 academic year, according to the statistical report of the Ministry of Higher Education and Scientific Research (2020b). The sample of the study was 120 teaching members selected randomly of the study community (see Table 1).

Table 1. Sample Distribution According to Gender and Educational Experience

Variable		n	Percent (%)
Gender	Male	89	74.2
	Female	31	25.8
	Total	120	100.0
Educational experience	Less than 5 years	14	11.7
	5 to less than 10 years	32	26.7
	More than 10 years	74	61.6
	Total	120	100.0

Instrument of the Study

To achieve the objectives of the study, the researchers built a questionnaire of 33 items under (3) main headings to get answers about the following issues:

- Strategies used by teachers to face electronic cheating.
- Problems they faced in implementing these strategies.
- Proposals for the developing anti-cheating strategies.

Likert scale was adopted in the questionnaire, (strongly agree, agree, neutral, do not agree, strongly do not agree) and it represents (5, 4, 3, 2, 1) respectively. The following equation was used to determine the answer levels: The upper limit of the scale - the minimum scale ÷ the number of categories required: (5-1) ÷3=1.33, and then add (1.33) to the end of each category. Thus, the following metric was adopted for results analysis: (1.00-2.33) Low, (2.34-3.67) medium, (3.68-5.00) high degree. The validity and stability of the questionnaire were approved, the first by (5) referees in the field of education, and the second by applying the questionnaire and reapplying it two weeks later on a reconnaissance sample of 30 students of the study community from outside its sample. Cronbach Alpha equation was used to justify the internal consistency and the stability of reapplication of the areas and the overall score as shown in Table 2.

Table 2. Internal Cronbach's Alpha Consistency Coefficient

Dimension	n	Stability coefficient by Cronbach's alpha	Stability coefficient by Re-test
Strategies followed to prevent electronic cheating	11	.93	.91
Problems encountered in applying electronic cheating prevention strategies	9	.89	.86
Suggestions for developing strategies to prevent cheating in electronic exams.	10	.87	.84

Table 2 shows that the stability coefficient of Cronbach's Alfa was between (0.87) and (0.93), and in the reapply manner was between (0.84) and (0.91). These values are acceptable for the purpose of the study.

Results

The First Question

"What strategies have the faculty members at Jordanian universities tried to face electronic cheating?" To answer this question, the mean, standard deviation and the level of use of strategies were calculated as shown in Table 3. Table 3 shows that the means of answers to the strategies were between (3.52) and (4.13), and that four of the strategies were at a high level while the rest at mid-level. It is clear that the mean of the overall degree of the strategies was (3.77) which is at a high level.

Table 3. Mean, Standard Deviation, and Level Strategies' Level

Classification	Role of E-exam	Mean	SD	Using level
1	Stating discussion questions that reveal student's knowledge.	4.13	.77	High
2	Using cameras in exams' administration.	4.04	.938	High
3	Encouraging students to do projects.	4.02	.78	High
4	Arranging students' achievements in portfolios.	3.98	.88	High
5	Encouraging students to send weekly ideas about their lessons.	3.67	.96	Moderate
6	Replacing exams with other assessment strategies.	3.66	1.03	Moderate
7	Replacing exams with assignments that require explanation of the answering method.	3.63	1.06	Moderate
8	Recognizing each student's writing style through normal or low-importance tasks.	3.63	1.01	Moderate
9	Assigning time limits in designing the exams.	3.62	1.12	Moderate
10	Using weekly quizzes as a part of evaluation.	3.61	.89	Moderate
11	Using activities as a part of evaluation.	3.52	1.08	Moderate
12	Overall score for the strategy axis	3.77	.58	High

The Second Question

"What problems did the faculty members face in implementing these strategies?" To answer this question, the mean, standard deviation and level of problems have been calculated. Table 4 explains this.

Table 4. Mean, Standard Deviation, and Problems' Level

Classification	Problem	Mean	SD	Using level
1	New forms of cheating (such as students' dependence on smart phone applications to exchange information)	4.29	.67	High
2	Electronic evaluation needs time to prepare.	4.09	.82	High
3	Preparing electronic evaluation requires a great deal of effort.	4.07	.86	High
4	Measuring students' expressive abilities.	3.91	.86	High
5	Preparing appropriate evaluation with clear specifications and criteria.	3.78	.96	High
6	Lack of adequate programs for similarity detection.	3.78	.96	High
7	Preparing consistent activities with educational content.	3.70	1.07	High
8	Preparing suitable questions for students with special needs.	3.69	1.06	High
9	Preparing question banks.	3.66	1.02	Moderate
	Total score of problems	3.89	.68	High

Table 4 indicates that the problems ranged from (3.66) to (4.29) with a general mean (3.89), and all except one were at an average level, that is "Preparing question banks".

The Third Question

"Are there statistically significant differences at the level ($\alpha \leq 0.05$) in the average overall degree of strategies used to reduce electronic cheating and the problems faced due to gender?" To answer this question, the mean, standard deviation, and the value of the t test for the overall score of faculty responses were calculated at the strategies and the problems faced in using those strategies according to the respondents' gender variable. Table 5 illustrates this.

Table 5. Total Score of Strategies and Problems

Dimension	Gender	Number	Mean	SD	t-Sample	Free degree	Siq
Strategies	Female	31	4.23	.34	5.67	118	.000
	Male	89	3.61	.57			
Problems	Female	31	3.97	.81	.77	118	.446
	Male	89	3.86	.63			

The results shown in Table 5 indicate that the t value of the strategies was equal to (5.67) and significant at the level (α =0.01) because the corresponding statistical significance value was smaller than this level. This means that there are statistically significant differences at the level (α=0.01) in the overall degree of the strategies attributable to the respondents' gender variable. Referring to the male and female means at the strategies; it is clear that the female mean was higher than that of males. Table 5 also shows that the t value of the problems was equal to (0.77) and was not statistically significant at the level (0.05) because the statistical significance value was smaller than this level.

The Fourth Question

"Are there statistically significant differences at the level ($\alpha \leq 0.05$) in the overall mean of strategies used to reduce electronic cheating among faculty members at Jordanian universities and the problems they faced due to the differences in teaching experience?" To answer this question, the mean and standard deviation of the overall score of faculty responses were calculated for strategies used and problems faced according to their teaching experience. Table 6 explains this.

Table 6. Responses on Strategies According to Teaching Experience

Dimension		Number	Mean	SD
Strategies	Less than 5 years	14	3.93	.30
	5 to less than 10 years	32	4.16	.47
	More than 10 years	74	3.58	.58
Problems	Less than 5 years	14	3.99	.66
	5 to less than 10 years	32	3.92	.71
	More than 10 years	74	3.85	.68

The results presented in Table 6 show that there were apparent differences in the overall mean score of the faculty responses at the strategies used to reduce electronic cheating and the problems they faced in using these strategies according to their teaching experience. To verify whether these differences are statistically significant, a single variance analysis test was used. Table 7 shows the results of the analysis.

Table 7. One-Way Analysis of Variance Results

Dimension	**Contrast source**	**sum of squares**	**degrees of freedom**	**Mean of squares**	**Value F**	**Indication level**
Strategies	In group	965.09	2	482.54	14.290	.000
	Between group	3950.91	117	33.77		
	Total	4916.00	119			
Problems	In group	23.61	2	11.81	.310	.734
	Between group	4448.36	117	38.02		
Total		4471.97	119			

The analysis of variance shown in Table 7 shows that the F value of the problems was 0.31 which is not statistically significant because the corresponding indication level value was greater than (0.05). This indicates that there were no differences in the degree of problems due to the variable teaching experience. On the other hand, the teaching experience variable had no clear impact on the level or degree of problems they had encountered in using strategies to reduce electronic cheating. Table 7 also shows that the F value of the strategies was (14.92), a statistical significance at the indication level ($\alpha = 0.01$) because the corresponding indication level value was less than (0.01). This means that the variable teaching experience played a role in the level of use of these strategies among the faculty members. To determine the source of these statistically significant differences in the strategies, Scheffé Test was used for multiple post comparisons as Table 8 shows.

Table 8. Scheffé Test for Multiple Dimensional Comparisons

Years of experience (a)	Years of experience (b)	The difference between the two averages (a-b)	standard error	Siq
5 to less than 10 years	More than 10 years	6.41216*	1.22947	.000

* The difference is statistically significant at the level ($\alpha = 0.01$)

The results of Scheffé Test in Table 8 show that the statistically significant difference in the overall degree of the strategies was between faculty members with teaching experience (5 to less than 10 years), those with teaching experience (10 years and older), in favor of the group (5 to less than 10 years).

The Fifth Question

What are the proposals of faculty members to reduce electronic cheating?" To answer this question, the mean, standard deviation and level of faculty proposals to reduce electronic cheating have been calculated. Table 9 explains this.

Table 9. Means, Standard Deviations, and Levels of Recommendations

Using level	SD	Mean	Suggested	Classification
High	.52	4.37	Diversification of electronic evaluation methods	1
High	.64	4.33	Distribution of test marks to multiple items of the electronic evaluation	2
High	.57	4.29	The use of techniques to verify the personality of the examiner.	3
High	.67	4.27	Employing software to detect electronic cheating.	4
High	.62	4.24	Providing programs that prevent hackers during the application of electronic evaluation.	5
High	.64	4.24	Recording all the examination events.	6
High	.67	4.17	Providing special platforms for electronic evaluation.	7
High	.69	4.15	Providing accurate standards for preparing electronic evaluation.	8
High	.76	4.13	Using cameras to monitor students during exams.	9
High	.83	3.97	Utilizing accurate software to track movements of the mouse pointer.	10

Table 9 shows that the mean of teachers' recommendations to reduce electronic cheating ranged from (3.97) to (4.37). It should be noted that all these recommendations were at a high level, indicating their importance in reducing electronic cheating. However, three of them received the top three grades: 1, 2, and 3.

Discussion

Depending on previous research findings, teaching staff members all over the world have faced a number of problems in evaluating their students, and so was the case in Jordan, especially at the university level during COVID-19. This study showed that the teaching staff members in two Jordanian universities used three main strategies to face electronic cheating: "Building discussion questions that reveal the students' knowledge", "Using cameras in the management of the exam" and "Sharing students in projects". This may be due to the importance they feel of evaluating not only student's knowledge, but also their understanding and creative thinking as well as skills and practical objectives achieved. This finding is consistent with Appiah & Van Tonder (2018) who emphasized the need to use different simulations and methods like creative projects to evaluate students' learning. On the other hand, three problems were faced by the teachers and got the highest ranking of importance: "New electronic applications that help students cheat", "Electronic evaluation needs time to set up", "Electronic evaluation setting needs a great deal of effort". These results may be due to the diversity of cheating methods among students, whether through peers or through use of Internet applications or mobiles. This finding agrees with Awdry & Ives (2020) who showed that students share answers with their colleagues through Internet applications. This makes it necessary to train faculty members on how to prepare tests in a way that prevents these types of cheating.

The study also reviled that the female faculty members used the strategies of facing electronic cheating at a higher

level than their male colleagues. This result may refer to the keenness of female faculty members to use question-based strategies that show students' knowledge, which may suggest that the ability of females to socialize this was more than males. This finding agreed with Cuadrado-García et al. (2010) who confirmed gender differences in the use and evaluation of e-learning. However, and as far as problems are concerned, no statistically significant differences between female and male faculty members were shown. This finding meets with Abduh, (2021) who studied the challenges teachers face in e-learning during the closure of COVID-19 and the problems faced by faculty members of both genders. Also, the teaching experience variable seemed to have no clear impact on the degree of problems the teachers encountered in using strategies to reduce electronic cheating.

The results also showed that teachers with (5 to less than 10 years) of teaching experience were more familiar with e-learning and more willing to integrate technology into the educational process, may be because they had fresh skills of using technology in addition to a kind of experience achieved during their first few years of teaching experience. This finding agrees with Al-Anazi (2021) who revealed that the response of faculty members with teaching experience (less than 5 years) and those with teaching experience (5 to less than 10 years) was better than those teachers with longer experience towards using various strategies to reduce cheating.

Conclusion

The conclusion of this study may well be applicable to other universities in the world. The study has come to a conclusion that electronic cheating has been a big problem facing teaching staff members at the university level in Jordan during COVID19 Pandemic. So, they have experienced several problems related to the lack of time and skills to set up electronic evaluation that they can accurately assess their students' knowledge, skills and creative thinking online. They used electronic exams, discussion questions, projects sharing as well as using cameras in the management of the exams. The female faculty members used the strategies of facing electronic cheating at a higher level than their male colleagues, while the teachers with (5 to less than 10 years) of teaching experience were more familiar with e-learning and more willing to integrate technology into the educational evaluation process.

Recommendations

Depending upon the findings and conclusion of the study, the researchers may recommend more training for teaching staff members at the university level as to be well acquainted and accurately skilled in preparing various types of electronic exams for online evaluation. There is a serious need to counter the spread of electronic cheating and to increased reliance on technology to maintain the accuracy and integrity of electronic evaluation.

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The Effect of STEAM Applications on Lesson Outcomes and Attitudes in Secondary School Visual Arts Lesson

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The Effect of STEAM Applications on Lesson Outcomes and Attitudes in Secondary School Visual Arts Lesson

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Abstract

STEAM is a concept that is made up of the initials of the words science, technology, engineering, arts and mathematics. The aim of this study is to determine the effect of STEAM-based teaching activities on students' lesson achievements and attitudes in secondary school Visual Arts lessons. The study was carried out in a private secondary school in Mersin. The study, which was carried out with 24 students in the experimental and 24 control groups for 5 weeks, was designed according to the experimental model with the control group, which is one of the quantitative research methods. In the study, Secondary School Visual Arts Lesson Acquisition Test and Attitude Scale towards Visual Arts Lesson were used as data collection tools. According to the research findings, there were significant differences in favor of the experimental group in the posttest achievement and attitude scores of the experimental group, in which activities based on the STEAM teaching approach, and the control group, in which traditional teaching was applied.

Introduction

According to the literature, artistic production has been in three stages, from past to present, 'traditional', 'mechanical' and 'digital'. With the industrial revolution, mechanization has developed and traditional art production has been replaced by reproduction. Technological possibilities that started with the camera have brought digital production to large masses through the computer. Researches and styles have changed with the different techniques that technology has added to the forms of art (Öztürk & Öztürk, 2022; Özdemir, 2022; Türkmenoğlu, 2014). In the second half of the 20th century, technological elements became widespread in different disciplines such as Pop Art, Op Art, Action Painting, Kinetic Art, Performance Art and Happening. The use of the internet in a wide area and the easy access of everyone to technology have created new art forms that can be followed and made in the digital environment (Ceran, 2022; Valuable and Türker, 2016). With the importance of computer software and technology, art has also been directly affected by these developments. Technology, as a tool in the creation of art, has also become an indispensable element for the art educator. Raising creative individuals, thinking fluently, finding original solutions to problems is one of the aims of national education. While determining the national education framework, it should be determined in the light of art and technological developments (Akdeniz et al., 2016; Kaleli, 2020; Kara, 2021; Karayağmurlar, 2002; Kibici, 2022; Kibici & Sarıkaya, 2021; Shettar et al., 2021). According to Sarıkaya (2022), Yılmaz and Bilici (2016), art

education can be made enjoyable, fun and effective by integrating technology into art education. In this way, the field of art can be made more interesting and the desire to learn can increase in the student. When it comes to the evaluation stage, it saves time and results can be reached faster and without errors.

The developments in the 21st century have brought about information to change rapidly and the need for information to increase more than ever before, and pave the way for countries to change and develop their educational needs and goals (Aslan, 2011). In order to improve the skills of students in the 21st century life, it is necessary to use engineering education accurately and effectively, especially on the basis of innovation and production (Alan, 2019; Gözüm et al., 2005; Rodriguez et al., 2020). The subject of learning by producing has been the main priority of many education systems. In the information society, it is seen as a necessity to increase mental processes and production skills rather than labor and muscle power. There is a need for students who can use technology, think, question, research and invent in accordance with the requirements of the age. Individuals' ability to think creatively, innovatively, creatively and critically in order to solve a problem when faced with a problem is a requirement of the developments in technology in the 21st century and the skills necessary to apply this technology (Sünbül, Gündüz & Yılmaz, 2002). This requires individuals to have access to in-depth knowledge in the fields of science, technology, engineering and mathematics and to be ready to use this knowledge in their daily lives. Based on this idea, in recent years, especially the United States of America, Japan, Korea, China and many European Union countries have started to apply STEM education, which includes a solid science and mathematics foundation, in many lessons and subject areas at pre-school, primary and secondary education levels in order to create an innovative society. Kier & Khalil, 2018; Williams & Young, 2021; Wu, Cheng & Koszalka, 2021). Bybee (2013) stated that although STEM education is an innovative approach, it supports the training of productive individuals who can use science and technology properly. Based on all these definitions, it can be said that STEM education plays an important role in the development of 21st century skills.

The concept of STEM is among the important concepts that emerged as a result of the rapid progress of science and technology in the 21st century. Developments in science and technology have required people of our age to have new and different skills. These skills, also known as 21st century skills, are expressed by P21 (Partnership for 21st Century Learning) as creativity and innovation, critical thinking and problem solving, communication and collaboration, media literacy, information literacy and technology literacy (P21, 2015). STEM covers the fields of Science, Technology, Engineering and Mathematics. STEAM, on the other hand, adds art to these areas. In fact, art has many different meanings, tasks and applications in STEAM education. Incorporating the humanities as well as the arts, it seeks to answer the question: How do we identify the challenges we want to overcome? The concept/product that emerged as a result of educational inquiries; It has been seen as a necessity brought by 21st century skills and professions. The concept of STEM should be taken seriously in terms of providing four different discipline skills in an integrated way and creating a society with developed skills in the disciplines in question. Recently, with the addition of the art field to the STEM concept, the concept has expanded and gained widespread use as STEAM (Razi & Zhou, 2022; Wu, Cheng & Koszalka, 2021). STEAM is positioned above the level desired to be reached with STEM. Within the discipline of art, there are contents such as aesthetics, handcraft skills, free design process (Yakman, 2008).

The basis of STEAM education is the use of different disciplines together, the preparation of projects and the realization of these projects by turning them into production. At the same time, STEAM education provides an environment for students to turn their projects into products on the axis of art, design and creativity. The most important difference of STEAM education is that it makes art and design an integral part of the education model (Erdoğan, 2020; Houghton et al., 2022). STEAM education has a framework for lesson plans that show how standards can be adapted, compared, and easily reinforced in unique and engaging ways. According to Yakman (2008), STEAM connects all its subjects to each other in an interdisciplinary manner and also to the whole spectrum of the rapidly changing business and professional world. It is a lifelong career and a way of being ready for life that can adapt to the rapidly changing global world we live in. Moving to the STEAM perspective means learning in an educational context; it not only has a framework that shows where topics overlap, but also provides a vibrant and adaptive learning framework for ever-changing personal and unpredictable global development (Houghton et al., 2022; Morales et al., 2021).

Art is a manifestation of creativity necessary for 21st century skills. It has been proven by experimental research that art develops many skills such as thinking, observation, verbal and written expression, and the inclusion of art in STEAM has also revealed in the researches the acquisition of skills such as better questioning ability, higher concentration and finding more effective solutions to problems. STEM education is generally based on logic and use of the left hemisphere of the brain. However, many studies have proven that areas where the right hemisphere of the brain is used, such as art, support and strengthen creativity. Considering that the basis of STEM education is the desire to reach the power of innovation, adding the term "art" makes this desire reasonable. In a STEAM-based education, students can have the opportunity to discover their potential by using their brains at full capacity. In addition, since the field of art is completely thinking-based, unlike memorization, it will reduce students' memorization habits and positively affect success in other fields (Poyraz, 2018).

By leading the development of divergent thinking, art supports the creative thinking that underlies the breakthrough innovations and inventions of scientists and engineers (Fox and Schirrmacher, 2018). For this reason, Leonardo da Vinci and Michelangelo Buonarroti, better known as painters and sculptors, have made many innovations in history (e.g. flying machines, catapults, suspension bridges) as inventors, engineers and scientists at the same time (Laurenza, 2018). ; Sousa and Pilecki, 2013). With this in mind, in recent years, researchers in the field of education have focused on the planning and implementation of educational processes in which art is included in STEM acronym and its contributions to both students and educators (Liao, 2019; Madden et al., 2013; Moomaw & Davis, 2010; Perkins & Stoycheva; 2016; Quigley and Herro, 2016).

Many educators argue that the arts should also be included in the integration of Science, Technology, Engineering and Mathematics, and that creativity supported through art is very important for generating new ideas in STEM disciplines (DeJarnette, 2018; Jamil et al., 2018; Madden et al., 2013; Wynn & Harris, 2012). Moreover, in addition to content such as mathematics, science and history, art is among the necessary subject areas for all students in the 21st century. The STEAM approach, which emerged from this point of view, can be defined as “instilling principles, concepts and techniques in the field of art and design into STEM teaching and learning” (National Art Education Association, 2014). It should be emphasized that; STEAM means much more than the

integration of art into STEM. The nature of STEAM reflects a more creative, real-world-oriented and problem- and/or project-based view of education (Henriksen et al. 2019).

The most important reason for the integration of art into STEM is the development of competencies related to aesthetics, innovation and imagination (Liao, 2019). In fact, art and STEM are different from each other in some ways. For example, while the disciplines that make up STEM are objective; art contains subjective expressions. Similarly, while STEM is analytical, analytical and more about logic; Art is emotional, instinctive and unique. On the other hand, the main goal of both is to make discoveries and both require creative thinking. In fact, skills such as making use of the sense of curiosity, which are considered as scientific tools, observing correctly, perceiving an object with multiple dimensions, spatial thinking and working effectively with others, are also at the center of art. In addition, not only artists but also scientists use creative thinking in their work (Sousa & Pilecki, 2013). Art and STEM education should be considered as the basic components of education that cannot be compared with each other, but complement each other (Jamil, Linder, & Stegelin, 2018; Ünal, 2022; Sousa & Pilecki, 2013). It is possible to give different examples of using art and STEM disciplines together. For example, physics, light, basic chemistry and trigonometry are the main learning areas of photography. Computer graphics or games; mathematical thinking, geometry, software and programming require artistic skills. As can be understood from these examples, this is why art and STEM disciplines are used together and art is included in engineering. Also, art makes STEM disciplines stronger, more attractive. In other words, it helps students to look at the world from a different perspective as visually literate (Mercin, 2019).

When the researches on the subject are examined, it is seen that many studies in the international arena (Cook, Bush & Cox, 2017; Kang, 2019; Liao, 2016; Moon, 2018; Pilkinton, 2018; Rolling, 2016; Sochacka) on STEAM education and STEAM teacher education in arts education (Guyotte & Walther, 2016; Stohlmann, Moore, Roehring, 2012; Tenoglia, 2017; Yakman, 2010). These studies draw attention to the fact that the lessons given with the STEAM education approach provide a more meaningful art education to the students in the field of visual arts, as in every discipline. In addition, it is seen that the education given with the STEAM approach creates an increase in the attitudes of the individuals towards the disciplines of Science, Technology, Engineering, Art and Mathematics that make up STEAM. Although there are few studies on STEAM education in Turkey, both in the field of art and in other fields, some educators (Ata-Aktürk, 2021; Azkın, 2019; Benek & Akçay; 2018; Erdoğan, 2020; Gülhan & Şahin, 2018; Helvacı, 2019; Kahya, 2019; Mercin, 2019) contributed to the promotion of this approach in art education with their publications such as book chapters, thesis and articles. In addition to the fact that STEAM studies are only studied by researchers in the field of science and mathematics, it is seen that the framework of applications that can serve as an example for the integration of these disciplines has not been clearly determined. The lack of sufficient number of studies to illuminate these points about the STEAM approach is considered as an important problem. For this reason, in this study, the effect of STEAM applications in secondary school visual arts education lesson on students' attitudes and achievements compared to traditional teaching was examined. For this purpose, answers to the following questions were sought in the study:

1. Is there a significant difference between the pretest-posttest lesson attitudes of the control groups in which the STEAM model-based applications are carried out in the 1st Secondary School 6th Grade Visual Arts Education lessons and the control groups in which the traditional teaching is applied?

2. Is there a significant difference between the posttest lesson attitudes of the experimental group in which the STEAM model-based applications were carried out and the control group in which the traditional teaching was applied in the Secondary School 6th Grade Visual Arts Education lessons?
3. Is there a significant difference between the pretest-posttest lesson acquisitions in the experimental group in which STEAM model-based applications are carried out in the 6th Grade Visual Arts Education lessons and in the control groups in which traditional teaching is applied?
4. Is there a significant difference between the posttest lesson achievements of the experimental group, in which the applications based on the STEAM model were carried out, and the control group, in which the traditional teaching was applied, in the 6th Grade Visual Arts Education lessons?

Method

In this study, it was tried to determine the effect of STEAM-focused painting teaching in the sixth grade Visual Sub-Learning Area, which is included in the Secondary School Visual Arts Curriculum, on the students' visual arts lesson achievements, their attitudes towards the lesson and their interest in STEM professions. The study was carried out in an experimental design. Patterns in which cause-effect relationships between variables are determined are experimental designs. In this study, quasi-experimental design was used in the data collection process. Quasi-experimental designs may be preferred when real experimental designs require but some control cannot be achieved. In this respect, quasi-experimental design is frequently preferred in the field of social sciences (Büyüköztürk vd., 2008). This study was conducted on secondary school students. Considering that making an unbiased assignment in the process of forming the study groups may cause some problems, a quasi-experimental design was preferred in this study. The symbolic representation of the pattern is given in Table 1.

Table 1. Experimental Design Applied in the Study

Groups	Pretest	Experimental Process	Posttest
G1	$T1_{12}$	STEAM-based Visual Arts Teaching	$T2_{12}$
C	$T1_{12}$	Traditional Visual Arts Teaching	$T2_{12}$

In the study, the Experimental group, in which G1 STEAM training was applied; C represents the control group in which traditional teaching was applied. Visual Arts lesson achievement and attitude scales were applied as a pre-test to both groups before the experimental procedure (T1). The same scales were applied to the groups as a posttest at the end of the experimental process (T2).
Pretests applied to the subjects according to the table above:

$T1_1$ ⟶ Visual Arts Lesson Achievement Test (Pretest)
$T1_2$ ⟶ Attitude Scale towards Visual Arts Lesson (Pretest)

In the study, the following experimental applications were carried out in the experimental and control groups:
Daily and activity plans were prepared to be used in the research based on the secondary school 6th grade Visual Arts lesson curriculum. In this context, a 5-week activity was planned in the 'Visual Communication and Formation' learning area of the lesson. Within the scope of this learning area, "Using different materials and

techniques while creating visual art work", "Ideas and experiences in visual art work; written, oral, rhythmic, drama etc. Experimental and control group sessions were held on the topics of "reflecting their ideas on visual art work in line with the chosen theme and subject" and "Using perspective in visual art work". Meanwhile, STEAM-based activities in the experimental group and traditional teaching practice in the control group were carried out. In the activities carried out in the experimental group, the students colored the visuals they created using their imaginations with the materials they cut in geometrical shapes, and turned them into reliefs and different pictures. In addition, within the scope of science activity, they associated their subjects with elements and stimuli from nature. Students made designs for visual communication and presentation individually and as a group in the engineering aspect of STEAM. Students who used the disciplines of design and mathematics in the visual arts lesson performed a fun presentation activity at the last stage. After the experimental procedures of the study, Visual Arts Lesson Achievement Test and attitude scale were applied to both groups as a post-test.

The study group of the research consisted of sixth grade students in a private secondary school in Erdemli, Mersin, continuing their education. In the study, two groups were selected, one being the experimental group and the other being the control group. In the experimental group, 13 girls, 11 boys, 24 students. In the control group, there were 24 students, 12 girls and 12 boys. Necessary permissions were obtained from the families and school administration in order to carry out the research. Before the experimental procedures of the research, the equivalence of the test scores of the students in the experimental and control groups was checked with the Mann Whitney U test and the results are presented in Table 2 and Table 3.

When Table 2 is examined, it is seen that the pretest visual arts lesson achievement scores of the students in the experimental and control groups are compared. As a result of the Mann Witney U test, it is seen that the pretest achievement scores of the students in the experimental and control groups did not differ statistically significantly [z=-0.435; p>0.05). Before the experimental procedures of the research, it was understood that the secondary school students in the experimental and control groups had equivalent visual arts lesson achievements.

Table 2. Comparison of Pre-test Visual Arts Lesson Achievement Scores of Students in Experimental and Control Groups

Group		N	Mean Rank	Sum of Ranks	Mann Whitney U/Z	p
Acquisition	Experimental	24	23.63	567.00	-0.436	0.663
	Control	24	25.38	609.00		
	Total	48				

When Table 3 is examined, it is seen that the pretest attitude scores of the students in the experimental and control groups are compared. As a result of the Mann Whitney U test, it is observed that the pretest scores of the experimental and control group students did not differ significantly from a statistical point of view [z=-1.342; p>0.05). Prior to the experimental operations of the research, it was understood that the secondary school students in the experimental and control groups had the same level of visual arts lesson attitudes.

Table 3. Comparison of Pre-test Visual Arts Lesson Attitude Scores of Students in the Experimental and Control Groups

	Group	N	Mean Rank	Sum of Ranks	Mann Whitney U/Z	p
Attitude	Experimental	24	27.21	653.00	-1.342	0.179
	Control	24	21.79	523.00		
	Total	48				

Data Collection Tools

The Visual Arts Lesson Attitude Scale (which was developed by Demirel (2011) to determine the attitudes of secondary school students towards the Visual Arts lesson was used. The scale consists of 24-item attitudes towards the Visual Arts lesson. The scale is in the form of a 5-point Likert. The answers given by the participants to the scale items are scored as “I strongly disagree, 2 Disagree, 3 Undecided, 4 Agree, 5 Completely Agree”. The highest score that can be obtained from this scale is 120. A high score from the scale indicates that the student's attitude towards visual arts lesson is high, if the score decreases, the attitude towards the visual arts lesson The Cronbach Alpha Coefficient of the scale was determined as .84. As a result of the analysis performed in this research sample, the scale was found to have a Cronbach Alpha Confidence Coefficient of .86.

Secondary School Visual Arts Lesson Acquisition Scale

Secondary School 6th Grade Visual Arts Lesson outcome scales developed by Yanal (2019) were used to determine the extent to which secondary school students achieved their Visual Arts Lesson achievements. In the scale there are expressions representing the achievements of the sixth grade Visual Arts Lesson. There are 21 items in the outcome scale prepared for the sixth grade. In order to ensure the validity of the scale, the achievements in the Visual Arts Lesson curriculum were taken into account and expert opinion was sought. A 5-point rating system was used to score the outcome scale. Visual Arts Lesson Achievement scale was designed as an observation form. The Visual Arts Lesson teacher gives points between 1 and 5 for each student according to the level of realization of the achievements in the scales by the students. A general score between 1 and 5 is obtained by dividing the scores obtained from the scale by the number of items. Scores of 5 and close to 5 indicate that the achievements of the Visual Arts Lesson have been realized to a large extent. In this study, the Cronbach alpha reliability coefficient, which was used to demonstrate the reliability of the scale, was found to be .92 for the overall scale.

Data Analysis Techniques

SPSS-23 was used in the analysis of quantitative data within the scope of the study. Shapiro Wilk is recommended when the number of observations is less than 30, and Kolmogorov-Simirnov is recommended when it is 30 or more (Ak, 2008). Since the sample size of the study was 48, Kolmogorov Smirnov test was used to test the normality of the data. In the study, it was decided whether the data showed normal distribution or not, using the

Kolomogorov Smirnov test, Descriptive Statistics values and Histogram graphics. In this context, since the research data did not meet the normal distribution assumptions, the Wlcoxon Sign test was used to look at the significant difference between the pretest and posttest scores of the Design Based STEM activities in the experimental group, the Wlcoxon Sign test to look at the significant difference between the pretest and posttest scores of the traditional teaching activities in the control group, Mann Whitney U test was used to compare the posttest scores of the groups.

Findings

When Table 4 is examined, it is seen that the posttest-pretest attitude scores of the students in the experimental groups are compared. As a result of the Wilcoxon signed-rank test, it is seen that the pretest and posttest attitude scores of the experimental group students differ statistically [z=-4.115; p<0.05). After the procedures performed in the experimental group, there was a significant increase in the attitudes of the students towards the visual arts lesson.

Table 4. Comparison of Pretest-Posttest Attitude Scores of the Students in the Experimental Group

Experimental Group		N	Mean Rank	Sum of Ranks	Wilcoxon Z	p
Attitude	Negative Ranks	0	0.00	0.00	-4.115[c]	0.000
Post-test—Pre-Test	Positive Ranks	22	11.50	253.00		
	Ties	2[d]				
	Total	24				

When Table 5 is examined, it is seen that the posttest-pretest attitude scores of the students in the control groups to whom traditional teaching was applied were compared. As a result of the Wilcoxon signed-rank test, it is seen that the pretest and posttest attitude scores of the control group students differ statistically [z=-4.112; p<0.05). After the teaching practices carried out in the control group, significant increases were observed in the attitudes of the students towards the visual arts lesson.

Table 5. Comparison of the Pretest-Posttest Attitude Scores of the Students in the Control Group

Control Group		N	Mean Rank	Sum of Ranks	Wilcoxon Z	p
Attitude	Negative Ranks	0	0.00	0.00	-4.112	0.000
Post-test—Pre-Test	Positive Ranks	22	11.50	253.00		
	Ties	2				
	Total	24				

The results of the Mann Whitney U test, in which the posttest scores of the experimental and control groups from the attitude scale towards the visual arts lesson were compared, are given in Table 6. As a result of the statistical processes, a significant difference was found between the posttest attitude scores of the experimental and control

groups (Z=-4.796; p>0.05). Accordingly, the students in the experimental group who were taught STEM-focused visual arts had higher attitudes than the control groups taught with the traditional method.

Table 6. Comparison of Posttest Visual Arts Attitude Scores of Students in Experimental and Control Groups

	Group	N	Mean Rank	Sum of Ranks	Mann Whitney U/Z	p
Post-Test	Experimental	24	34.17	820.00	-4.796	0.000
	Control	24	14.83	356.00		
	Total	48				

When Table 7 is examined, it is seen that the posttest-pretest visual arts lesson achievement scores of the students in the experimental groups are compared. As a result of the Wilcoxon signed-rank test, it is seen that the pretest and posttest achievement scores of the experimental group students differ statistically [z=-4.287; p<0.05). After the procedures carried out in the experimental group, there was a significant increase in the gains of the students in the visual arts lesson.

Table 7. Comparison of Pretest-Posttest Visual Arts Lesson Achievement Scores of the Students in the Experimental Group

Experimental Group		N	Mean Rank	Sum of Ranks	Wilcoxon Z	p
Acquisition	Negative Ranks	0[e]	0.00	0.00	-4.287	0.000
Post-test—Pre-Test	Positive Ranks	24[f]	12.50	300.00		
	Ties	0[g]				
	Total	24				

When Table 8 is examined, it is seen that the posttest-pretest visual arts course achievement scores of the students in the control groups are compared. As a result of the Wilcoxon signed-rank test, it is seen that the pretest and posttest achievement scores of the control group students did not differ statistically [z=-1.795; p>0.05). After the traditional teaching practices carried out in the control group, no significant increase was observed in the visual arts course achievements of the students.

Table 8. Comparison of Pretest-Posttest Visual Arts Lesson Achievement Scores of the Students in the Control Group

Control Group		N	Mean Rank	Sum of Ranks	Wilcoxon Z	p
ACQUISITION	Negative Ranks	9[e]	8.78	79.00	-1.795	0.073
Post-test—Pre-Test	Positive Ranks	14[f]	14.07	197.00		
	Ties	1[g]				
	Total	24				

The results of the Mann Whitney U test, in which the posttest scores of the experimental and control groups from the visual arts lesson outcome test were compared, are given in Table 9. As a result of the statistical processes, a significant difference was found between the posttest achievement scores of the experimental and control groups ($Z=-5.026$; $p<0.05$). Accordingly, students in the experimental group taught with STEM-oriented visual arts achieved a higher level of attainment compared to the control groups taught with the traditional method.

Table 9. Comparison of Posttest Visual Arts Lesson Achievement Scores of Students in Experimental and Control Groups

			Mean		Mann Whitney	
		N	Rank	Sum of Ranks	U/Z	p
Port-test	Experimental	24	34.63	831.00	5.026	0.000
	Control	24	14.38	345.00		
	Total	48				

Discussion and Conclusion

In the discussion part of this study, which was carried out in order to determine the effects of the activities carried out based on the STEAM approach, in accordance with the secondary school Visual Arts curriculum, on the achievement of the lesson achievements of the 6th grade students and their attitudes towards the lesson; The sub-problems were associated with the findings obtained from the data collection tools, compared with other studies on the subject, and the extent to which the solution of the sub-problems of the research was achieved was examined. Examining the findings in the study, it was found that the students in the experimental group, who were applied STEAM, developed significantly higher attitudes towards the visual arts lesson compared to their peers in the control group, which was applied traditional teaching. These findings are in Darling-Hammond & Bransford (2005), Henriksen (2014), Kim et al. (2014), Kong & Ji (2014), Nadelson, Seifert, Moll & Coats (2012), and Uğraş (2018). According to Darling-Hammond & Bransford (2005), integrating science-technology-engineering-mathematics and art education into the curriculum of STEM-based activities in the teaching process provided more participation in the learning processes of the students, affective learning products, and meaningful and permanent learning experiences. According to Henkriksen (2014), incorporating art into the STEM approach reduces students' anxiety about the lesson and increases their motivation and attitudes in a positive way, even though it is difficult and time-consuming in classrooms. With the inclusion of an interdisciplinary approach in art, in-class participation also increases. In addition, students have the opportunity to see the connection between Science, Mathematics, Technology and Engineering disciplines and Art. In STEAM applications, the students' creation of a product by making small designs motivates the students towards the lesson. When students produce a product at the end of the applications, they see that their current knowledge works and they are motivated to learn more.

Another finding of this research is about the effect of the activities based on the STEAM approach on the achievements of the 6th grade students in the visual arts lesson. According to the research findings, it was seen that the students in the experimental group, who were applied with STEAM, achieved significantly higher visual

arts lesson gains compared to their peers in the control group, which was applied traditional teaching. These findings are similar to those of the research conducted by Bae (2011), Cook, Bush & Cox (2017), Kang (2019), Kim (2015), Liao (2016), and Mishra (2011). Educational activities with the STEAM approach contribute to the teaching of that discipline in many ways, regardless of which component it is based on. The STEAM approach used in teaching science subjects enables students to learn the lesson content better and to increase their perceptions about STEAM subjects (Kim, 2015). While STEAM trainings are effective in increasing secondary school students' attitudes towards technology, they also increase students' attitudes towards using technology in lessons and developing creative activities (Bae, 2011). In general, the transdisciplinary nature of STEAM teaching is compatible with the nonlinear problem-solving and open-ended nature of creative thinking (Mishra et al., 2016), encouraging students to create a space to use their imaginations (Eisner, 2002). All these situations indicate that STEAM contributes to meaningful and effective learning in the visual arts lesson, where creativity and imagination are important. On the other hand, art and engineering education includes activities based on problem solving. This method gives students the ability to think at a high level. Considering that art is always a form of mass communication, students can create more original, functional and aesthetically balanced objects with STEAM applications (Bequette & Bequette, 2011).

As a result, STEAM education, which provides the integration of all knowledge and skills in science-technology-engineering-mathematics and art disciplines, should be popularized in schools and out-of-school learning environments, considering that it positively changes the attitudes of students towards the Visual Arts lesson and increases their achievements. In this way, it can be said that the interest and motivation of the students will increase with the inclusion of art among these fields that can be seen independently of each other, while the decreasing interest in both visual arts and science and mathematics is increased. In order for this method to be effective in schools, necessary equipment and resources on STEM/STEAM should be provided in Visual Arts workshops, and teachers should be trained on this subject. The research is a quantitative study. It is important to evaluate similar studies to be carried out in the future in a holistic way and to gain a different perspective.

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New Teachers' Perceptions of Their Impact on Student Learning While Developing Knowledge and Skills to Teach Online

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New Teachers' Perceptions of Their Impact on Student Learning While Developing Knowledge and Skills to Teach Online

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Abstract

Due to the health pandemic of 2020, teachers have been forced to initiate online teaching delivery models with little preparation just as students and parents have had their routines abruptly altered from in-person schooling to hybrid and fully online instruction (Mecham, et al., 2021). The pandemic brought to light new opportunities for novice teachers to learn how to implement pedagogical strategies using digital tools to support student learning and development in remote settings. As part of a larger case study of 23 novice teachers who graduated from our urban institution, these results focus on new teachers' perceptions of their own development and their impact on student learning while teaching online, during the pandemic. Semi-structured interviews focused on educators' approaches to instruction across 12-18 months of the pandemic. Data were analyzed using NVivo through open coding. Findings help us understand these new teachers' perceptions of their impact on student learning while developing knowledge and skills to teach fully online. Four themes are highlighted in this study as a glimpse into new teachers' perceptions of themselves and their impact during this time. New teachers describe their impact on student learning as their ability to build relationships and trust with learners and their families, to use students' funds of knowledge to engage them in meaningful tasks, to teach with digital tools, modeling and collaborating with learners, and to incorporate various digital tools to monitor progress, assess, and provide feedback online. Novices describe student engagement and motivation as resulting student outcomes due to their abilities to build relationships, tap into students' multiple knowledge bases, and use digital tools to teach and assess student learning. They describe their new knowledge and skills teaching online as unintended outcomes related to their own development and learning.

Introduction

Due to the health pandemic of 2020, teachers have been forced to initiate online teaching delivery models with little preparation just as students and parents have had their routines abruptly altered from in-person schooling to hybrid and fully online instruction (Mecham, et al., 2021). Despite little to no preparation in their teacher education programs, the pandemic brought to light new opportunities for novice teachers to learn how to implement

pedagogical strategies using digital technology to support student learning and development in remote settings (Martin et al., 2022). Research is in its early stages in helping us understand how teachers, especially novice teachers, engaged remotely with learners and their families, for some the first time in an emergency crisis, implementing online pedagogical tools, platforms, and apps (An et al., 2021). Little research is prevalent on PreK-5th grade online teaching and learning, with more research centering on distance education in virtual academies, in middle and secondary settings, or on higher education online courses (Barbour, 2019; Wagner, 2022). Additionally, there is limited research focusing on teachers' perceptions of their impact on student learning while learning to teach online during a global pandemic.

Literature Review

The many challenges of the pandemic are highlighted in the literature on K-12 online teaching and learning when teachers were faced with teaching online or in concurrent settings with little to no preparation (Mecham et al., 2021; Ranellucci & Berge, 2020; Trust & Whalen, 2020). Martin et al. (2022) described the pandemic as having an impact on several facets of learner engagement and thus the need for immediate strategies and supports for teachers and learners. For this study, we examined the literature on teachers' perspectives of their impact on student learning and development while developing knowledge and skills to teach online. An et al. (2021) and Wagner (2022) report on teachers' perspectives on the pedagogical strategies and support structures that teachers implemented and found beneficial. For example, six elementary teachers described their abilities to sustain student learning as they utilized online software platforms (e.g., Zoom, Google Meet) to provide synchronous instruction in an effort to build relationships and community in safe spaces for social interactions. These teachers also incorporated multiple forms of media and digital apps to differentiate instruction to engage in teacher-led or student-led instructional activities (Wagner, 2022). However, Le et al. (2022) investigated the interaction patterns of learners and how teachers engaged them online finding that teacher-student interactions and student-content interactions were more prevalent than student-student interactions due to a lack of teacher facilitation of discussion and the dominance of the teacher in Vietnam as the source of knowledge.

An et al. (2021) conducted a mixed methods study, utilizing an online survey and interview data from 107 U.S. teachers and described their approaches similarly using online software platforms, with synchronous instruction preferred over asynchronous, and hands-on learning via digital tools. Additional instructional strategies included project-based learning, especially at the middle and secondary level, and game-based learning. The researchers also noted some differences in the types of tools that teachers used depending on grade level. For example, *Seesaw* was more prevalent with elementary aged learners, while *EdPuzzle, NearPod*, and online assessment tools were the teachers' choice tools with middle and high school students. Other types of software such as the Google Suite were common across grade levels (An et al.). Similarly, in the Zheng et al. (2020) study, high school teachers found online platforms, various types of online software, and multiple digital apps beneficial to teaching and learning online when tied to pedagogical goals, especially to provide flexible, personalized learning opportunities (e.g., project-based assignments) and differentiated instruction for their learners. Considering the future of education in K-12 classrooms and the preparation of new teachers, this study examines novice teachers' perceptions of their own development and their impact on student learning while teaching online, during the

pandemic. Our case study examined the 2020-2021 pandemic teaching experiences of novice teachers who graduated from our programs. The purpose of the study was (a) to understand novice teachers' perceptions of their impact on student learning and development during this emergency shift to online teaching and (b) to describe novice teachers' perceptions of their own development of knowledge and skills during this time.

Method

As part of a larger study, 23 participants [i.e., 3 Special Education (13%), 3 English Language Arts Education (13%), 5 Social Studies/History Education (22%), 3 Mathematics Education (13%), 3 Elementary Education (13%), 1 Science Education (4%), 2 Music Education (9%), 1 Art Education (4%), and 2 ESOL Education (4%)] were graduates of an urban research institution and had completed teacher preparation programs within the previous two years. The participants self-reported as 6 males (26%) and 17 females (74%), of which are 11 Black (48%), 8 White (35%), 2 Asian (9%), 1 Multiracial (4%), and 1 with no report (4%). Participants taught in teaching positions across a range of grade levels including elementary (6 or 26%), middle level (10 or 43%), and high school (7 or 30%) (see Table 1).

Table 1. Description of Participants' Teaching Position

ID	Content and Grade Level	Teaching Position
ID 120	Special Education (4th grade)	Elementary
ID 212	Elementary (4th grade)	Elementary
ID 304	Elementary (5th grade)	Elementary
ID 305	Special Education (3-5th grade)	Elementary
ID 602	ESOL (Elementary)	Elementary
ID 704	Math, Science (5th grade)	Elementary
ID 204	Language Arts (8th grade)	Middle Level
ID 205	Language Arts (6th grade)	Middle Level
ID 311	Middle Grades Science (8th grade)	Middle Level
ID 312	Mathematics (8th grade)	Middle Level
ID 406	Social Studies (6th grade)	Middle Level
ID 407	Mathematics (Middle grades)	Middle Level
ID 702	Music, Reading (Middle grades)	Middle Level
ID 801	Social Studies (Middle grades)	Middle Level
ID 902	Music, Drama (6th grade)	Middle Level
ID 903	Social Studies (Middle grades)	Middle Level
ID 203	Special Education (9th grade math)	High School
ID 206	History (11th grade)	High School
ID 207	English (10th grade)	High School
ID 209	Geometry (9th grade)	High School
ID 211	Art (High school)	High School
ID 313	History (High School)	High School
ID 601	ESOL (High School)	High School

Semi-structured, individual phone interviews of 30 – 45 minutes were conducted, recorded, and transcribed in Otter.ai. Data were transcribed using Otter ai and analyzed using NVivo through open coding and axial coding following a constant comparative method (Corbin & Strauss, 2008). The research team coded separately and met to create initial codes. Further consensus among the researchers led to the development of categories and final themes. Themes were divided among members who recoded the entire data set and shared results with the overall team. The data subset for this study examined participants approaches to instruction across the months of the pandemic, instances where they impacted students' learning and development and their perceptions of their students and their own development of knowledge and skills across the year.

Results

Findings help us understand these new teachers' perceptions of their impact on student learning and development while developing knowledge and skills to teach fully online with little to no preparation in their programs to teach online. Four themes are highlighted in this study as a glimpse into new teachers' perceptions of themselves and their impact during this time (see Figure 1). New teachers describe their impact on student learning as their ability to:

(a) build relationships and trust with learners and their families,

(b) use students' funds of knowledge to engage them in meaningful tasks,

(c) teach with digital tools, modeling and collaborating with learners, and

(d) monitor and assess learning online by incorporating various digital tools to monitor progress, assess using data, and provide feedback.

Novices describe student engagement and motivation as resulting student outcomes due to their abilities to build relationships, tap into students' multiple knowledge bases, and use digital tools to teach and assess student learning. They describe their new knowledge and skills teaching online as unintended outcomes related to their own development and learning.

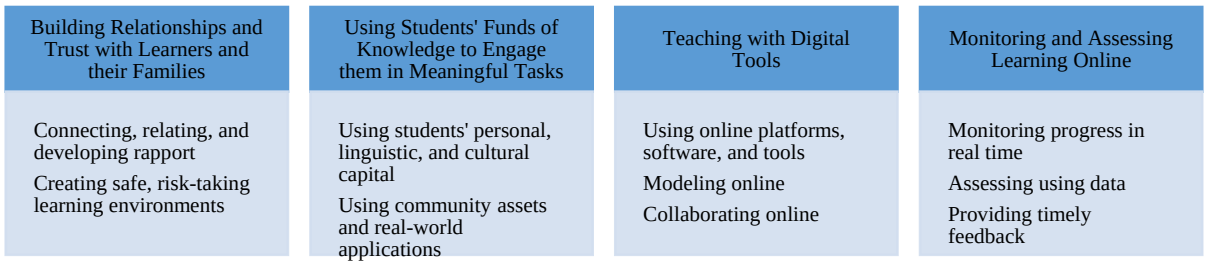

Figure 1. Novice Teachers' Perceptions of Their Impact on Students

Building Relationships and Trust with Learners and their Families

New teachers highlighted their perceptions of their effectiveness at having an impact on student learning and development as their ability to develop strong relationships with their learners and families. They shared how getting to know their students, developing rapport, and connecting and relating with students was important for engagement and success. They encouraged a lot of exploration and experimentation in the digital environment

and created safe spaces where their students felt comfortable taking risks and learning from mistakes. Teachers indicated that ongoing communication with students and their parents was a key to student learning.

Connecting, Relating, and Developing Rapport

Two special education teachers, one elementary and one high school, described their abilities to impact student learning and development by connecting, relating, and developing rapport with their learners and their families. The first teacher explained how breakout rooms were used to get to know students, while the second teacher discussed how connecting and developing rapport breaks down barriers:

> Yeah, I think, with the students who did participate online…we in mostly with my co teacher in the agenda setting, we were able to develop strong relationships with fellow students. You know we got to know them, and they got to know us, and we are able to create, you know, fun and engaging lessons and pull them in breakout rooms and in small groups and whatnot. (ID 305)

> They don't mind listening to you and taking advice from them so once you can connect with a student it is easy to teach so powerful…you know, teach them life or anything, so I think that connection that rapport…I think this is the first piece of you know, breaking down that barrier. (ID 203)

An elementary special education teacher and a middle grades music teacher both recognized that *parents are their main supports* for successfully engaging their learners in online settings and for follow up on their assignments. They commented,

> But being in constant contact with the parents, because they're the ones who are responsible for getting the kids up and having them in front of their Chromebook or whatever device that the student uses. And that's what we prided ourselves on that communication with both the parent and the student. (ID 120)

> Really a lot of it is attributed to family support. And, and I would have students that would turn in everything on time, and we'd be fully engaged and would be at every class, and, and those, those students were obviously more successful; you attend class and you're going to be more successful; you participate in class you're going to be more successful. (ID 902)

Two more teachers at the high school and middle school level explained how establishing trust in an environment where students know you care about them and what they have to say is important for their development and academic success as noted in their comments:

> So being able to be relatable and has helped me as an educator, because I think, first, I'm one of the most important things, as an educator, you have to build relationships. Before you can teach a student who has the have that environment or feel like they can trust you and feel like you care about them. So, before you can even get into their mind and student development as far as academics, you have to make sure that you are setting the tone as far as relationships. (ID 206)

> And also inject all these opportunities for them to have a say and have a voice. Most kids like typing in the chat. If I was like, unmute they'd be like, No, but like type in the chat, they're like yeah I can do that.

> So we got to the point where I just had to like kind of accept that we're going to spend more time than I think we should typing in the chat and talking about our weekends, and, you know, asking silly questions in it, even if it's just a one silly question before class gets started, but just trying to get them engaged from the start. I found to be really important. (ID 702)

All these teachers acknowledged the value and necessity in building relationships and trust with their learners and families to support student learning and development.

Creating Safe, Risk-Taking Environments

In addition to building relationships, the novice teachers described how they created safe, risk-taking spaces for their learners to experiment and try out new things. Students were allowed to share anonymously, if desired, when further support was needed due to a lack of understanding. These art and social studies teachers also described how their learners felt free to make mistakes to learn more and could seek further support, saying,

> Well, I always like to tell my students that they're supposed to make mistakes. If they don't make mistakes, then what, you know, what's the point of me being there to help them because that means they're perfect, and no one's perfect. I encourage a lot of experimentation. I tell them, you know, nothing's you sometimes you're supposed to fail. And that's, that's the way to learn is through failure. (ID 211)

> There were several every day that they, they come in, I'll give them an index card and let them write yet. And then for my online kids out, I would have them do a Google form and it was anonymous. And they could write down any questions, comments, or concerns that they have. About one of them would be about material about content that I was teaching. And another one would be about anything that they just needed to ask me or whatever. And it could be anonymous, they also could put their name on there. And so, then the next day or at the end of class, I would kind of go over it. So being able to, to create, like a safe place where they know they won't get caught out. And they don't understand material. And being able to do the same thing with my digital kids just virtually. (ID 801)

In addition to building relationships and trust with learners and their families, a first step to ensuring for student development and learning, the novice teachers recognized the importance of tapping into their students' funds of knowledge to engage them in meaningful and relevant tasks, connecting their personal, linguistic, and cultural experiences to their academic learning in real-world contexts.

Using Students' Funds of Knowledge to Engage Them in Meaningful Tasks

Novice teachers described their ability to impact student learning and development, often referring to culturally responsive pedagogy (Lawrence, 2020), by using students' personal, linguistic, and cultural capital to engage them in learning experiences. They incorporated video games, music, slang, and what was popular among their learners to hook them into learning. Additionally, they used local community events, places, and activities as they planned for instruction. Furthermore, they pulled in current real-world events to provide additional application of content knowledge and skills.

Using Students' Personal, Linguistic, and Cultural Capital

Using their students' funds of knowledge (González et al., 2005) to engage them in meaningful tasks, teachers shared how they used their students' personal interests, linguistic and cultural capital. Some of them commented about using slang, music, such as Hip Hop, and figurative language saying, "I try to use music a lot because I do know that the students that I teach, they love music and figurative language you know everything is in music, it's just the whole (ID 203)." Another commented,

> …you know incorporate using, using terms, hip hop terms in my in my lessons, trying to get them to connect with the listener. You know, I know, video games, music is the main way to get to them…And you know just be, just be culturally relevant about what was popular with them; you know even sometimes the slang that I kind of taught like sometimes try to make sure. (ID 203)

Here a middle level teacher highlighted the use of figurative language to connect to students personally:

> So, I teach Physical Science, which is like half physics and half chemistry. And so, in the second semester, we, we were talking about the periodic table and atoms, how they bond together and all that, and I found that adding personification to the atoms that I was describing helped my kids understand them, a lot. (ID 311)

A music middle level and ESOL high school teacher described impact on student learning and development as effective teaching online using culturally relevant materials that represented different cultures and groups as noted:

> I'd say that culturally responsive pedagogy is a high priority for me regardless of whether I'm in person or online. And I'm make a real point to make sure that we sing repertoire that represents different cultures, different languages that the composers and the arrangers are a diverse group of people that we have. Immigrants, minorities, women, you know so that so that there is a lot, represented. I would say, I would say really. I'm lucky that I have a nice library, and I was still able to have a diverse, a diverse set of literature for them. (ID 902)

> I would say that's one of the ways in which it was different because you still have a lot of access to good multicultural materials online. For example, we did a unit on face challenges and workers' rights. Leading up to play by Chinese Day in March. And so, so I was able to share a lot of resources, I had some physical resources, which came with my phone, and then upload. And then of course there are articles which are really access online songs even on YouTube videos. So, I would say, culturally responsive resources are much more readily available online than offline were much more accessible. And so, I didn't feel like there was much of a drop off or any drop off at all that, compared to what I was doing in person. (ID 601)

Connecting to personal histories was also a method used by these novice teachers as described by this high school art teacher:

> It's so, so for some kids, they have trouble coming up with ideas for some kids that they really use their own background, their own personal history, to create engaging and incredibly interesting pieces of work. You know, I had a student who was, who considers himself a Latin X. And she wanted to write specifically, a booklet about all the Latin artists that are sort of looked over, you know, perfectly was

> amazing, she did a ton of research, I ended up going library, getting books for her, and bringing them to class and the books, she loved the book so much, she asked me to take them home to her parents. So, I do try to, I try to make sure that the students are bringing in their own opinions are understanding that their personal history, and also their own aesthetics, valuable in their ability to create things. (ID 211)

Using Community Assets and Real-World Applications

Novice teachers also shared how they *used their students' community assets and real-world applications* to engage their students in local and global events. Two teachers, language arts and history, commented:

> Unfortunately, there were a lot of different types of events that was taking place throughout the whole course of this year, so we use all of those events to actually use as a lesson which had kids actually engaged so they were learning about the stuff that was going on in their community, they learned about what's going on in the world. And, you know, bringing it to the classroom so that they know that they are important. (ID 205)

> Let's talk about the current event let's talk, let's talk about what's going on in society because this is a social studies class, so we can kind of, you know, dive in and digest this whole incident and see how can we improve as, you know, citizens of America, you know, So that was pretty cool, being that it was something that caught us off guard, but we as educators, we had to have that conversation. (ID 206)

Two more teachers, middle level and high school social studies/history alluded to the events of the election year and the racial strife occurring in the U.S. and their abilities to impact student learning in meaningful discussion and activity. They explained the following:

> Then when they got really political because of the election year. The kids were really vocal about their thoughts, and you know and if we would have, they would have debates. And so that would be awesome in the beginning and then when I was transitioned to social studies, we had to learn, like sixth grade so they learned about the governance systems in Europe and in Canada and in Latin America, so when they were learning about different government systems. They were actually coming like comparing it to ours and then coming up with what they thought the perfect government was like, we should have…and so I want to say like I made eye contact with them being like kind of like global citizens because they started being like, okay, so when I grow up I want to live here because I like how they do that there, or when I grow up, they can vote at 16. I think you know and or they care about the environment, so definitely watching the news, definitely, social studies, and having them, knowing what was going on in present time that real applications. (ID 406)

> So, this year, one of my other colleagues that went to [XXX] and graduated as well, from the MAT program [name]. We both started an organization a grassroots organization in [name] County, just basically seeking equity across the board at the district office, as well as in throughout the school district. And so, what was very interesting was, I was able to kind of show my students what was going on in their, in their hometown. So, for them to really understand, you know, why it's important to vote. Why is it important to be politically responsible and knowing what's going on in your society? (ID 313)

An elementary education teacher used problem-based learning to provide a real-life application experience for learners using community food trucks and menu design related to concepts of budgeting, marketing, and economics. The teacher explained:

> Coincidentally, it happened like on the last quarter, and we did a PBL project. So, the problem-based learning, so we did a food truck activity, where the students had to come up with a menu design, they had to come up with a price for it, their own local, and they had to come up with a design for a food truck, and this aligned with my social science lessons through finishing up with economics. And so they were learning about budgeting we've talked about consumers and marketing and competition… I was able to give the students a project and this is actually where they learned the most because they would actually apply like math back to math because they had to add subtract decimals, and they had to make connections with economics… they were able to make real life applications to, to what they see every day [because] we talked about like how restaurants now sell chicken sandwiches, because chicken sandwiches, got really popular. (ID 304)

Elementary, middle level, and high school teachers described many ways that they were able to build relationships with students and their families and use their students' funds of knowledge to engage them in meaningful tasks. They also became well versed in teaching online developing their own familiarity and comfort using online platforms, software, and tools to teach remotely.

Teaching with Digital Tools

Teaching in the digital world brought about new and unexpected learning experiences for both the novice teachers and their students. Teachers reported their surprise that they were able to model well online using digital tools and apps that they had discovered mostly through trial and error. They realized that they could show students how to do something and even collaborate to help them revise or try another strategy online. Furthermore, they acknowledged that there were new ways for students to interact with not only the teacher but also other students online. They described some of the online platforms, software, and digital tools that they used to model and collaborate online to create teacher-student and student-student interactions.

Using Online Platforms, Software, and Tools

Novice teachers referred to their new knowledge and skills teaching and impacting student learning by experimenting with various digital tools, platforms, and software and digital technology to model and create collaborative learning environments for their learners. One high school special education teacher explains,

> But I will say it pushed me out of my comfort zone; I blew down development. I learned some new technology platforms that we can use, even when the students come back, because especially in special education you have to make sure that you have different stations may be hands-on one may enjoy or using technology in the classrooms is now a one stop shop. You have to offer different strategies and different platforms for students to excel and be great. As far as development, they're learning. (ID 206)

Another teacher found a free software program to support student learning in her art class:

> And then of course, getting materials to kids. I rearranged the entire way all my projects are done. So that it's something we can do from home, and I teach the digital art classes that require software that kids can't buy. So, I had to improvise, I had to find for example to do half of the work that software they could buy to do and then another free software that did the other half or something. So, these are things that I've had to change. (ID 211)

An ESOL teacher discussed online platforms and helpful digital tools to support instruction:

> And then starting when they had their Chromebooks. I gave a lot of instruction in terms of how to use a lot of the online resources that they were expecting to use like G Suite stuff. And I still continue to make use of some other online resources like Quizlet for making flashcards for our class under other classes. And then also continuing to develop their ability to use NGC, apps and programs for their assignments, and also Google Classroom was our sort of learning management system that we use… (ID 601)

Teacher Modeling

In addition to becoming comfortable teaching with online platforms, teachers acknowledged their new abilities to use digital tools to model instructional strategies online and support student learning. An elementary mathematics teacher explained her use of digital mathematics manipulatives to model and guide student understanding of fractions:

> Oh, I want to say a lot of my impact really came in the subject of math. And I know that's a really hard one more time, I felt like doing other subjects were a little bit more difficult over doing hybrid, but math was a constant because of technology. So, I was able to like, you know, math is really important when you have to use manipulatives with younger students…more hands on things, but because we can't do hands on, and because we can't physically give students manipulatives, I was able to find those manipulatives digitally online, where students can still have that physical movement and actually see what was being done. So, for instance, we were focused really heavy on fractions. This year is a fourth grade so obviously, when fractions isn't easy, so when you're normally teaching that you want to use fraction bars or fraction circles, and when we're hybrid, or when we are online completely, that's really hard to have that per student. So being able to have this virtual fraction strips or fraction bars or fraction circles really helped my students see. (ID 212)

Both the following art and elementary teachers provided additional examples of modeling to physically show students what they need to see as well as collaborate with them to support their understanding:

> They're virtual, they're fully virtual. So, so I found a bunch of different programs online that did a bunch of different things. And one of them I found was, was great because it was, it was created as a sort of design collaborative program. So, if the students create an account with it, and then they share that account with me, I can actually go into the program while they're in it, and move stuff around and physically shows, you know, like how, maybe if a student was in person, and I wouldn't be drawing over their drawing to show them where they made their mistakes. In this case, it was a virtual setting where I can collaborate virtually. So, So, this, this helps a lot of my students understand very technical things… (ID 211)

> And so, when we would do math, I would model it for them. And then I would give it to them for them to do themselves or whiteboard. And as they were working, I could see what they were doing. And it showed me how different students what steps they took to get to the answer. So, students could just do the math, they got it. Some students would use different techniques of how to do math, like a different, different adding techniques or multiple or multiple, repeated addition, things like that I was seeing they're working the problem out in the way that they feel would get them to the answer. And that was probably one of the best parts about being in my small group was using the whiteboard. Because I can actively see the students working and it was kind of like being in the classroom again, because I was in the classroom, I could see them working on their paper. (ID 602)

Screensharing became commonplace during synchronous instruction as a way to guide students so that they could see what they should be doing as modeled on the teacher's screen. One teacher indicated,

> So when they're supposed to be working on projects, what I like to do is I like to screen share the same project they're working on except my version of it. And so it's become a thing where we're learning from each other. (ID 211)

Teacher-Student and Student-Student Collaboration

Not only were teachers able to model for learners to guide instruction; but also, the novice teachers explained how they were able to use digital tools to collaborate, creating not only teacher-student interactions but also student-student interactions online. Two middle level mathematics and elementary teachers provided examples:

> We did like a gallery walk. And this one was nice because my digital students did it on Jamboard and my in-person students did it [on] chart paper, and I liked it because they were. We learned about center and spread. And then they were responding on sticky notes and then responding to the responses. So that was nice because I could see their thinking. The first time is that I could listen to their conversation about other students' responses, and some of them are sorting them by like correct and incorrect responses or like moving the sticky notes around to show. Like what, what responses really were the best. (ID 312)

Using Nearpod, a digital platform, to teach reading, the elementary teacher explained how her students interacted in concurrent settings:

> So, in that way with doing that I was able to have all my students and the students in the classroom work together. So, if I wanted to do partner work, because of social distancing, I would pair an online student with a student in the classroom. It went really well. That's when I would notice a lot of the students, a lot of the online students were way more engaged, but they were able to talk to the people that were in the classroom, instead of just talking to the people that are just online with them. (ID 212)

Additionally, an ESOL elementary teacher explained how students interacted with the mathematics content on Google slides by annotating:

> So, I had my, I had different number sense activities for each day. And then I had actual problems that related to the whatever we were learning that week or those, those couple of weeks. So, we went over

> adding three-digit numbers place value, some, some a little bit of geometry, partitioning, we're kind of getting them to think about equal groups, because that's coming in third grade. And that's where I really had to, I use a Google, Google Slides for that. And I really had to learn how to put things on the slide so that the students can interact with the material. (ID 602)

Not only did novice teachers become adept at teaching with digital tools; but also, they found the digital world to be a place that was surprisingly conducive to monitoring and assessing student learning online as will be discussed next.

Monitoring and Assessing with Digital Tools

New teachers described their impact on student learning and development related to assessment recognizing that they incorporated various digital tools to monitor student progress in real time, to assess using data, and to provide timely feedback. Assessing student learning by providing timely, actionable feedback beyond grades was an unexpected outcome for teachers who noticed an increase in student motivation and engagement in learning.

Monitoring Progress in Real Time

Teachers described how they monitored progress in real time by being able to watch and see what students were doing as they were working online. A middle level and elementary teacher explained their use of digital tools such as Amplified, whiteboard, and Edpuzzle to watch, listen for, and see student responses:

> So, it's like, we have to do writing the platform called Amplified, where it was basically like an app like everybody like logging into it and then we go through it together and you could monitor their work. But in doing that they had to write a lot, and they would really see their writing and then I could go on the Google Doc and make those immediate corrections [like you] were in person. (ID 406)

> We use this platform a lot called whiteboard, and whiteboard, you can set up a class as a teacher, and then you send a link out to the students, they click the link, and they set up their own whiteboard. And then from there as the teacher you can see what they're doing with their work on whiteboard. So, I did that a lot with my fourth-grade math group that I did that I had a small group with. (ID 602)

> It was towards the end of virtual, but I used it so much, I started to use it more with a lot of my classes. It's called Edpuzzle. Edpuzzle is a platform where you can basically people can take people can make videos, or they can take you to videos, and have different points in the video where they stop. And the program asks the question, and the students have to answer. And then it goes with the video, it goes with the lesson that you're teaching. (ID 602)

Another teacher teaching in special education described a digital assessment tool to see students' interactions and responses on formative assessments saying, "Use this program called Go Formative is kind of like your, your slacker in home-based teaching program where I can see if you're interacting (ID 203)."

Assessing Using Data

Using data from formative assessments was perceived by these novice teachers as instrumental in guiding their students' learning and development. Two middle level education teachers described how they used data from formative assessments to assess learning and plan for instruction:

> There are several times this year where I would put them into groups based on their responses to some formative assessment, and those, those I think were my favorite lessons, because I would pull my small groups and work with them on, you know, whatever they misunderstood and then leave the rest of the kids or maybe split them into two different groups to have them go off on their own, like they could log off and work on the activity independently or stay on and be in a different breakout group so those I think were my best days when I really saw student growth. (ID 312)

> I mean, we did, they took a writing score assessment early in the year. So, then I took the results from that and use that to divide them up into groups, and then was able to provide, like different targeted learning for each level based on those scores. So that was a good opportunity to use the data positively, to go back and inform those groupings. (ID 204)

A high school history teacher described the importance of formative assessment to learn what students need, saying,

> I found it in the Avid strategy book, to ask for student feedback, what works for you, you know, just kind of like, yes or no question. But it helped me understand what my students need. Because, you know, I just asked for that student feedback. Sure. I activated that in my classroom, and at first I wasn't doing that, I was kind of assuming. But when I asked what do, what, what will work for you, or what do you need help, and help me. (ID 206)

Providing Timely Feedback

Overwhelming, teachers described how they were able to successfully provide timely feedback online to their surprise much better than in person. An unexpected outcome they highlighted was their ability to motivate student learning through feedback rather than grades. Several teachers provided examples of their experiences. One middle level teacher explained that feedback can be specific and given quickly, noting:

> I found that the online teaching allows me to give more specific feedback quickly. So, I have enjoyed that aspect of it. Because I can, I can type a message to a student way faster than I can hear them ask question and respond verbally. And I can get to them in order of importance. See, like, who's actually struggling? And who's asking, you know, questions that they could reasonably find the answer to. So, it's a lot quicker to feel those responses and give appropriate feedback in online environments than it is in person. There's a lot less distractions online as well. (ID 204)

An art high school and music middle level teacher discussed how the online platform allowed for personalized comments, and for students these constructive remarks made them eager to turn in work and the teacher ccould see their progression. They commented, saying,

> Well, I think I think with an online platform, being able to give written feedback, like, you know, paragraphs of feedback, for every single assignment was, was something that I wouldn't have done in person, you know, in person, I tend to give a lot of verbal feedback. And then I'm just like, Oh, yeah, they're gonna totally remember what I told them to do. But I think having written feedback was a huge one. And having it on an online platform where they could go and see like, comments from me on their in progress, or the rough drafts or something like that is very beneficial to their own development. (ID 211)

> It's just so we use Microsoft Teams, and through all the different counties use different platforms out there. But on Microsoft Teams, you could even write a little comment. As you're giving them back grades, and I felt it was kind of naked to just give back a grade. So, I found myself giving comments for every single student. And then I got overwhelmed. But I was like, I started this I can't stop. So, once they started to expect this, I realized, they're, they're more eager to turn in work, because they know I'm going to give them feedback. You know, why? Why would they just, it's funny, these kids are not motivated by grades. They're motivated by constructive comments. (ID 211)

> But, but they were singing, and one of the great things about that is that I was able to give them personalized feedback, which is something that I have not done before because if everyone's in the classroom, you give basically feedback as a group… that was really gratifying for me especially when I would hear progression throughout the year, you know, again, students that really were working on their vocal technique, the way that I was teaching them, and you know I would I would give them specific feedback. (ID 902)

Even at the elementary level, a math/science teacher found that instant feedback was gratifying for learners. This teacher used a digital, Live Worksheet as a tool, saying,

> And then as far as the worksheets, I found this resource called Live worksheets, and that was great because not only do they have premade, I can make them the worksheets myself; it graded them for me. [They] see their grade right away when they got in, like, instantly because that you know that instant feedback is very important so that was a great resource to use that. (ID 704)

Teachers provided examples of their excitement when they realized that they could monitor and assess student learning in real time, including the provision of timely feedback. Data were used for formative assessment purposes, and teachers reported that digital technologies were effective in helping them use assessments to plan for instruction as well as to assess student learning and provide next steps for individual learners. Individual learners were motivated to use the feedback and to turn in assignments.

Novice teachers shared their perceptions of their impact on student learning and development that were in some ways aligned to their program preparation and in other ways learned on the job during the pandemic where online and concurrent teaching became the norm. Building relationships and trust with their learners and families as well as using students' funds of knowledge to engage them in meaningful tasks were areas of focus in their programs which had a social justice mission. These teachers were prepared to plan, teach, and assess in settings that were

primarily in person. While they had many hours of clinical experience, primarily in yearlong student teaching placements, including preparation to use technology for student learning, they were not prepared to teach in online or in concurrent settings. The teachers highlighted several unexpected outcomes as they were learning alongside their students. They relied more heavily on parents and families as supportive partners. They were able to model and collaborate, interacting and creating safe spaces for students to interact with each other online. Assessing and providing timely feedback online beyond grades proved to increase student motivation and engagement as did facilitating courageous conversations related to community and real-world events.

Discussion

These study results are enlightening and shed a positive slant on our teachers' perceptions of their impact on student learning as they were developing knowledge and skills as learners themselves during the abrupt switch to teach online. Most teachers exuded some confidence teaching online as expressed by their positive perceptions of their contributions to student learning and their developing knowledge and skills to teach online, a similar finding in self-efficacy studies for online teaching (Dolighan et al., 2021) and others (An et al., 2021; Mecham et al., 2021; Wagner, 2022). Teachers were able to make connections and build relationships with a community of learners using online platforms and software, engaging students in synchronous instruction including breakout rooms. Additionally, they brought in parents online to support their launch of activities and to engage students in learning. Unexpectedly, their view of parents shifted from outsiders to insiders who were truly partners in teaching and learning as also noted in the literature (Mecham et al., 2021, Wagner, 2022). Our graduates, like other teachers, were able to use learner-centered approaches such as problem-based learning, collaborative online learning involving teacher-student (Le et al., 2022) and student-student interactions, hands-on manipulative activities with learners, and online discussions (An et al., 2021, Wagner, 2022). Confirming the literature, our teachers observed unexpected outcomes (i.e., motivated and engaged students) while teaching online (An et al., 2021). These results were corroborated in this study when teachers incorporated students' funds of knowledge in activities involving real-world applications and provided timely feedback requiring student responses online. As also noted by Sahlberg (2021), students were engaged in learning when their learning experiences were in authentic contexts and were self-directed.

This study provides evidence from a range of teachers across the elementary, middle, and high school levels, including special areas art, music, and ESOL, where new teachers described their use of multiple digital tools and platforms to support student learning. Findings provide further evidence of the impact elementary teachers have on young learners in grades 3rd-5th, as also noted in Wagner's (2022) study. Use of song, video, annotated Google documents, and multimodal forms of media are some of the ways that students engaged with these new teachers in synchronous online settings. Using a variety of digital technologies, teachers were able to be flexible in meeting the needs of their learners in ways that they may not have discovered had it not been for this shift in modality to online instruction. Additionally, most teachers in our study used digital tools and apps to differentiate instruction and assessment via modeling and feedback. Similarly, teachers who adapted instruction online were successful in meeting the needs of individual learners (Mecham et al., 2021).

Conclusion and Recommendations

The purpose of this study was to understand new teachers' perceptions of their impact on student learning and development during the pandemic, in the spring of 2021, after they had begun teaching online in their first or second year of teaching. These findings add to and confirm the literature that teachers are reporting more positive perceptions of teaching online at all levels, even in the elementary grades (An et al., 2021, Mecham et al., 2021, Wagner, 2022). Future research is needed on teachers' perceptions of their effectiveness teaching online across grade levels, elementary, middle level, and high school. While this study provided a sample of participants who were teaching across grade level ranges, the smaller number of participants within the grade ranges may be a limitation of this study. The perceptions of the new teachers in this study regarding their impact on student learning while developing their own knowledge and skills to teach online provide recommendations for school leaders, teacher educators, and current teachers. School leaders may consider offering differentiated professional learning for teachers on the use of digital technologies, while teacher educators should prepare new teachers to use digital technologies to teach online (An, et al., 2021; Hall, & Trespalacios, 2019). While teachers have experienced challenges teaching online, there is much to learn from their positive experiences and approaches to teaching and learning. Communication with parents as true partners is key as is using various digital tools in both online and face-to-face environments. Incorporating more opportunities using digital tools for real-world student applications during instruction as well as timely feedback is important for student engagement and motivation as self-directed learners. Waite and Arnett (2020) provide additional examples of programs showing impact on student learning when educators integrated new resources, incorporating technology, and implemented new instructional processes. Resources alone did not prove to be beneficial, but rather the combination of the resources and the instructional processes employed by teachers helped to close equity gaps in learning. As noted by Sahlberg (2021), when teachers provide opportunities for learners to engage in authentic learning online, students may become self-directed and reach their fullest potential. Schools may become more equitable when positive outcomes are identified and capitalized on with support for teachers and their autonomy to ensure for the success of all learners.

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An Examination of the Factors and Challenges to Adopting Gamification in English Foreign Language Teaching

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An Examination of the Factors and Challenges to Adopting Gamification in English Foreign Language Teaching

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Abstract

The purpose of this study is to identify key factors and barriers to implementing gamification in English Foreign language teaching. In alignment with the purpose of the study, the perspectives of English teachers (which grades) were obtained. This study was designed as a qualitative study. A total of 16 teachers participated in the study. Structured interview questions were used as the data collection instrument. The data obtained from the interviews were analyzed using content analysis. The result of the study demonstrated that most teachers use gamification in their English Foreign Language teaching. Some teachers who participated in the study indicated that gamification is very effective and important for their teaching and that they use gamification frequently in their teaching. Teachers emphasized that games facilitate language learning, ensure active class participation, make learning more enjoyable, and make the learning process effective and efficient. In addition, games facilitate the development of student language skills and make learning more enjoyable by making lessons interesting. Factors such as the occurrence of problems like irregularities, objections, and challenges during the game, the creation of a negative competitive environment, the extension of the time allotted for the game, and the creation of a noisy environment were found to be barriers to the use of gamification in the classroom. In addition, technical difficulties and problems with digital games, lack of technology and internet, technology, screen, and game addiction, and health/psychological issues are some of the main reasons why teachers do not use gamification in their EFL teaching.

Introduction

In their daily lives, most students play video games that require many skills such as solving problems using facts and information in context and receiving feedback, they use to win the games. Failure provides feedback and opportunities for learning, teamwork is essential, and learning and assessment are strongly linked. As educators, we can reinvent the learning experience by engaging this pervasive and compelling gaming phenomenon. Gamification is the introduction of game elements into non-game environments to leverage the motivational factors of games (Fulton, 2019).

Gamification in education is the process of turning the classroom and everyday activities into games (Haiken,

2021). It necessitates imagination, teamwork, and fun. Gamification in learning refers to the use of game-like aspects such as point scoring, score tables, teamwork, and peer rivalry to increase student engagement, help them absorb new material, and assess their knowledge (Gamification in Education, 2020). It can be employed in school-based topics, but it is also frequently used in self-teaching applications and courses, demonstrating that gamification's impacts do not end when we reach adulthood.

There are various ways to include games and game play in the classroom to increase learning and deepen student knowledge. Teachers can employ gamification features to improve learning and student engagement, whether they want to incorporate some aspects of gaming into their class or use a game platform across the curriculum. The theory behind gamification in education implies that learners learn best when they are also having fun (Fulton, 2019). Not only that, but kids learn best when they have objectives, milestones, and accomplishments to strive for, all while remaining enjoyable to the learner. According to the Gamified Learning Theory, gamification does not directly affect learning but rather activates a learning-related behavior through a mediating or regulating process (Zaric, Roepke, Lukarov & Schroeder, 2021). Learner-related behavior may be anticipated to some extent depending on how learners perceive, comprehend, and use information. Learning inclinations are the many approaches to learning. Flow theory, self-determination theory, and self-efficacy theory form the foundations for supporting gamification (Fulton, 2019).

Gamification has proven to be extremely useful in a variety of situations, including e-learning environments, educational settings, and even corporate training (Gamification in Education, 2020). Games cater to fundamental human needs (autonomy, value, competence, etc.), and enhance social skills. For example, games may feature leader boards or locations where high-scorers are shown so that players feel validated when they do well. Games enhance continuing engagement by allowing players to challenge their friends or ask others to participate. Gamification helps users interact by encouraging them to keep playing and earn more points and rewards, or simply discover more information. Davis (2014) assumes that we have gotten this far thanks to social media and word-of-mouth recommendations. He advises that now it is time to put serious games to the test to see which ones are suitable for classroom use. Rather of depending on unknown algorithms to select the greatest learning games, the education world requires a screening process that goes beyond the non-teaching game company employees who now evaluate what is good and what is not.

Gamification in English as a Foreign Language (EFL)

EFL is becoming widespread in non-English speaking countries (Turan & Çimen, 2018). To acquire a new language, learners need to stay motivated and engaged in the learning process. In recent years, EFL teachers have aimed to keep the motivation high in their classrooms by including technology and games (Turan & Çimen, 2018).

In recent days, technological advancements made their way into education. Technology can help in developing problem-solving, critical thinking, and collaborative work. These skills are essential in education as it is the skills needed in the 21st century. Gamification is a teaching technique that improves critical thinking, problem-solving,

and collaborative work (Díaz & Zajia, 2020). It is a new educational method that encourages learners to learn using game elements in the learning environment (Tamtama, et al., 2020). Games have rules, interactivity, and feedback which helps in motivating learners. Gamification is the newest strategy used in teaching EFL (Turan & Çimen, 2018). Turan and Cimen (2018) investigated the impact of gamification on vocabulary learning using a pre-test and post-test on 61 middle school students. The researchers used gamification tools such as Kahoot and Class Dojo. They have concluded that using gamification can positively affect students' vocabulary learning, and the students were motivated to learn.

Web 2.0 Tools as to Gamify EFL Teaching

Web 2.0 tools are internet tools that allow users to create content and interact with other users' content (Mohammad, Assam & Saidi, 2020). With the use of web 2.0, learning became more interactive, and student-centered. Web 2.0 allows the learning environment to become collaborative, which increases learners' academic performance. Communication, interaction, and information sharing can enhance learners' language learning. Studies showed that using Web 2.0 to teach a foreign language affects learners' motivation to learn the language (Aşıksoy, 2018). Web 2.0 has been used a lot in the EFL context, and it engages learners by making it fun and motivational.

Recently, the game-based Kahoot application has been one of the most commonly used 2.0 tools in education. Kahoot is a gaming website that creates competition between learners where students should select the correct answer. The fastest student that chooses the correct answers gets the highest scores. Kahoot presents quizzes in a game show format creating a fun environment. Another web 2.0 tool is Mentimeter for designing interactive presentations, quizzes, and word clouds. The teacher can present a question, and learners' type in their answers. The answers will immediately show on the teachers' screen (Gokbulut, 2020). A game-based environment enhances learners' engagement, learning experience, and cognitive development (Almusharraf, 2021). Learning using a game-based environment does not mean that it will increase learners' academic development in EFL. However, it increases their engagement and motivation, enhancing their learning experience.

Keeping student learning attention on the subject is one of the biggest challenges in digital age. Therefore, educators look for ways to capture student attention and motivate them to complete certain tasks and impart knowledge in an entertaining way. To achieve this goal, one of the most important techniques used in education in recent years is gamification. Therefore, gamification has become very popular in education. Many educational institutions are already using gamification to increase student motivation. Gamification can be used not only in the classroom, but also for professional development purposes. It can be used in any area where learning takes place.

There is no consensus in the literature on the definition of gamification. However, the most common description of gamification is the use of game elements and game design techniques in non-game contexts to digitally engage people and motivate them to reach their objectives (Betts et al., 2021). The history of gamification dates to the 1900's and began with cash incentives and coupon codes. It gained popularity when the internet became available

to the public. Companies adopted gamification applications for marketing purposes and used virtual rewards and other gamification incentives.

During the learning process, it is important to motivate students to focus on the lesson. In order to motivate the new generation for lessons and keeping their interest is challenging task for teachers. Gamification, or the incorporation of gaming tools into non-game environments, provides an opportunity to solve such problems. Teachers can use gamification in their teaching process for any suitable content and student profile by selecting appropriate gamification tools and supporting the content.

Gamification can be used in the context of motivational benefits, resulting psychological outcomes, and subsequent behavioral outcomes. When gamification is well designed in accordance with the intended content, student motivation to engage in learning activities will increase. Thus, intended student learning outcomes and behaviors will be achieved. Intrinsic motivation is the tool that gamification can use to enhance the student learning experience. It demonstrates a student's passion to complete a specific learning task.

The use of gamification in teaching can be defined as making learning more fun and interesting by incorporating game elements and game thinking into the teaching and learning process to motivate students and increase their engagement (Kapp, 2012). The power of gamification in foreign language learning is widely recognized among foreign language teachers. Gamification activities motivate language learners when used properly in the foreign language classroom (Lee & Hummer, 2011).

Most of the foreign language learning students face challenges from learning a new language associated with motivational factors (Al Issa, 2006). Gamification can be used as a tool to solve this problem in foreign language learning. Since gamification can be integrated into the teaching and learning process as a pedagogical approach to motivate students to learn by using game mechanisms in teaching environments. The goal of this approach is to increase student enjoyment and engagement by tapping into their interest and encouraging them to continue learning. There are several reasons why teachers of EFL use gamification as a pedagogical approach. First, gamification is a tool that gives students immediate feedback and puts them in charge of their learning. Second, the gamified learning environment gives students the freedom to fail and try learn without negative consequences. Finally, gamification brings more fun and enjoyment to the learning environment and makes learning more visible.

The Purpose of the Research

The purpose of this study is to identify the factors and barriers to adopting gamification in EFL teaching. This study is important as it measures the impact of gamification tools on EFL teaching. In line with the purpose of the study, the opinions of English teachers were obtained. In this context, the research questionnaire:

RQ1: What are the main factors that support EFL teachers when using gamification in their teaching?
RQ2: What are the key barriers that EFL teachers face when using gamification in their courses?

Method

In this part of the study, information is given about the method that was used in accordance with the purpose of the research. For this purpose, information is given about the research model and the participants of the study. The subtitles of the data collection instruments and data analysis are also included in this section.

Research Model

This study was designed as a qualitative study. Qualitative research uses data collection methods such as document review, interview, and observation. Qualitative research can be described as a research process that deals with events or perceptions in a natural setting in a holistic and realistic manner. The goal of qualitative research is not to arrive at results through numbers, but to provide the reader with a descriptive and realistic picture of the subject. Nevertheless, it is possible to make some numerical analyzes of the data collected by qualitative methods (Yıldırım & Şimşek, 2013).

The case study design was chosen for this research. Case studies are a qualitative research design in which the researcher examines a current phenomenon, process, or action in its real-world context in-depth and detail (Creswell & Creswell, 2017; McMillan & Schumaher, 2010). In other words, factors related to a situation (environment, processes, individuals, events, etc.) are examined using a holistic approach that focuses on how they affect the situation. In this method, where data are systematically collected, analyzed, and the results presented, an event, situation, or process is studied in all aspects with a limited number of samples (Yıldırım & Şimşek, 2013). In this study, the case study design was used because it aims to identify teachers' opinions on the factors and barriers to adopting gamification in EFL teaching.

Participants

The research participants are teachers working in public or private schools in Ukraine, and Turkey. The teachers participated in this study voluntarily. Snowball sampling was used in this study. In this method, a person is selected for the subject of the research and other people are reached through this person (Biernacki & Waldorf, 1981). According to this method, participants were identified by asking the teachers interviewed in this study about the topic of the study, e.g., "who or whom would you recommend interviewing". The distribution values according to the demographical characteristics of the teachers participating in the study are shown in Table 1.

Table 1 shows that a total of 16 teachers participated in the study, 11 (68.75%) from Ukraine, and four (31.25%) from Turkey. Regarding age groups, six (37.5%) teachers are under 25 years old, five (31.25%) teachers are 25-30 years old, and four (25%) teachers are over 30 years old. One of the teachers did not indicate his/her age. Seven (30.43%) of the teachers teach primary students, five (21.74%) teach secondary students, seven (30.43%) teach high school students, and one (4.35%) teaches university students. One teacher teaches adults.

However, two teachers did not indicate which grades they teach. Since some teachers teach more than one grade, the value of level is high. Participants' work experience varied from 0-14 years. Half of the participants (50%)

have 1-3 years of teaching experience. In addition, six (37.5%) teachers have 4-6 years of teaching experience, and two (12.5%) teachers have 7 years or more of teaching experience. Again, most teachers (56.25%) work in public schools, while some (37.5%) work in private schools. Although one teacher has not indicated in what kind of school s/he works.

Table 1. Demographical Characteristics of the Teachers

Variables	Category	f	%
Country	Ukraine	11	68.75
	Turkey	5	31.25
Age	<25	6	37.50
	≥25, ≤30	5	31.25
	≥31	4	25.00
	Not mentioned	1	6.25
Grade taught*	Primary school	7	30.43
	Secondary school	5	21.74
	High school	7	30.43
	University	1	4.35
	Adults	1	4.35
	Not mentioned	2	8.70
Years of experience in teaching	≥1, ≤3 years	8	50.00
	≥4, ≤6 years	6	37.50
	≥7 years	2	12.50
Current institution you work at	Public	9	56.25
	Private	6	37.50
	Not mentioned	1	6.25

* *Multiple options selected*

Data Collection Instrument

In this study, structured interview forms were used as a data collection instrument. In the structured interview technique, the researcher asks the same questions in the same way and using the same words with each research participant. The answers given by the person are closed-ended (Türnüklü, 2000). In structured interviews, the list of questions should not be exceeded. In structured interviews, the researcher does not go beyond the set questions. The interview form consists of questions that emerged from the literature review and were created by the researchers themselves.

In preparing the interview form, a conceptual framework was created, a literature review was conducted, and interview questions used in related studies were examined. To ensure the validity and reliability of the interview form, the opinions of two different experts were obtained. According to the feedback, the necessary arrangements were made and the interview questions were finalized. The interview form contains a total of 10 questions, five

of which are related to demographical characteristics and five of which are related to gamification in EFL teaching. Care was taken to ensure that these questions were understandable, open-ended, and flexible. Prior to the interview, teachers were informed about the upcoming meeting. They were also advised of the importance of answering the questions in the interview form honestly.

Data Analysis

The data obtained from the interviews were analyzed using content analysis. Content analysis is to reach concepts and relationships to explain the data obtained. The data obtained should first be conceptualized and then organized by putting them into a systematic and logical form that corresponds to the concepts formed. Accordingly, the themes that explain the data should be identified. The goal is to present the results to the reader in an organized and interpreted form (Yıldırım & Şimşek, 2013).

During the analysis process, the data from the interviews from each teacher were organized. The next step was to code the data and create a code list. After reviewing the codes, themes were found that could group these codes under specific categories (Renner & Taylor Powell, 2003; Yıldırım & Şimşek, 2013). Finally, the codes of the identified themes are presented in tables with frequency and percentage values.

In this final stage, detailed comments were provided to explain the relationships between the results and to clarify the significance of the results. Below the table, which was created as a result of the content analysis, one-to-one quotations were made from the teachers' opinions. In accordance with the ethical rules in the transmission of quotations, teachers were given the codes T1, T2, … T16 (Teacher 16). In addition, the researcher took care to avoid comments and generalizations in the data analysis.

To increase the reliability of the qualitative data analysis, re-coding was performed by two experts. As part of the content analysis method, some of the teachers' opinions on each topic were directly quoted to ensure the validity of the research and to strengthen the ideas presented. The coding conducted and the themes identified were reviewed by the researcher and the agree or disagree questions were discussed. The study used the reliability formula proposed by Miles and Huberman (1994) to calculate the reliability of the data analysis. As a result of the analysis, the reliability was found to be ~84%. If the reliability value is above 70%, it is considered reliable for the reliability of the study (Miles & Huberman, 1994). Therefore, the obtained result was accepted as reliable for the study.

Results

As part of the study, teachers were first asked whether they use gamification in their EFL course. If they use gamification, they were also asked how long they had been using gamification in their course. In addition, teachers were asked what type(s) of gamification activities they most commonly use in their course. The responses are presented in Table 2.

Table 2 shows that most teachers (87.5%) use gamification in their course. Two teachers indicated that they do not use gamification in their course. Three of the teachers (18.75%) have been using gamification in their course for 1 year or less. On the other hand, half of the teachers (50%) have used gamification in their course between 2-4 years. The percentage of those who have used gamification in their course for 5 years or more is 18.75%.

Table 2. Distribution of whether Teachers use Gamification in their Courses

Variables	Category	f	%
Have you ever used gamification in your courses?	Yes	14	87.50
	No	2	12.50
How long have you been using gamification in your courses?	≤1 years	3	18.75
	≥2, ≤4 years	8	50.00
	≥5 years	3	18.75
	Not used	2	12.50
Type(s) of gamification activities most commonly used in courses	Digital	6	42.86
	Non-digital	5	35.71
	Digital & Non-digital	3	21.43

Some teachers indicated that gamification is very effective and important to their teaching and that they use gamification frequently in their course. Teachers use gamification in their course to make the class fun, activate students, and ensure their participation in the class. In addition, teachers use gamification in their course because gamification helps to motivate students, increase interest in learning, and support skill development.

The study also asked teachers to indicate the type(s) of gamification activities they use commonly in their course. A look at Table 2 shows that teachers use many gamification activities in their course. Six teachers who participated in the study preferred digital gamification tools in their course. Teachers who prefer digital gamification tools generally use games such as Kahoot, Plickers, DuoLingo, Voki, Padlet, Quizizz, and Hangman with Vocabulary in their classes.

On the other hand, five teachers prefer non-digital gamification tools. In addition, three teachers use both digital and non-digital gamification tools in their course. In general, teachers prefer many gamification activities their course that include group activities, are interactive, allow students to review information learned, and make lessons fun. For example, teachers prefer to use genres such as competition games, map travel game, card games, matching pictures with words, translation cartoons, creating fairy tales, playing bingo cards for language learning. In addition to this, they prefer utilizing interactive worksheet, matching activity games, who wants to be a millionaire, memory games, puzzles and intelligence - cards in their course beside gamification tools.

The study also included teachers' opinions on the key factors that encourage them to use gamification in their course. The related results are shown in Table 3. The teachers mentioned situations such as "Increases interest and attention to the course" (f=6), "Increases motivation" (f=5), "Makes the course attractive/entertaining" (f=4), "Makes learning more enjoyable" (f=4) as the main drivers/factors encouraging them to use gamification in their

courses. One teacher expressed his opinion on this situation with T3:

> *Thanks to games the lesson becomes more interesting and it's the best method for making students participate actively during the lesson. Even adults like to play in the classroom, it is always fun and can be very educational for everyone. It helps to develop our communication skills; some games force us to solve different problems and find solutions to them. Anyway, it won't be boring lesson and in the future it will attract more students as no one likes ordinary activities*".

Another teacher expressed his opinion on this issue with T12:

> *When my students play a game, they learn easily and they have fun. When I see their learning, I think I should use games in my lessons. They learn and have fun at the same time*.

Still another teacher expressed his opinion in the form of T8:

> *Gamification is a great way to make students enjoy their learning process while playing. Most of the time, students conceive school as an obligation without really understanding the purpose of it. With gamification, students can break their motivation barriers and realize that school is a fun and safe space to learn*.

Table 3. Teachers' Opinions on the Main Drivers/factors that encourage them to use Gamification in their Courses

Main Drivers/Factors	f
Increases interest and attention to the course	6
Increases motivation	5
Makes the course attractive/entertaining	4
Makes learning more enjoyable	4
Facilitates and encourages the development of language skills	3
Facilitates student interaction with their teachers and classmates	2
Facilitates learning	2
Ensures active participation in the course	2
Ability to easily dedicate students to school/classroom	1
Promotes curiosity in students	1
Provides opportunities for students to explore a particular topic	1
Ensuring the elimination of prejudices about school	1
Develops communication skills	1
Encouraging students to complete objectives	1
Make classroom time more efficient	1

Teachers were also asked to identify the main barriers to using gamification in their course. Their opinions can be found in Table 4. The main barriers for teachers to use gamification in their course are "Lack of technology and internet" (f=3), "Encountering disciplinary problems in crowded classes" (f=2), "Lack of motivation" (f=2), "Students' apathy" (f=2), "Technical difficulties and problems in computerized games" (f=2) was specified. One teacher expressed his opinion on this in the form of T8: "*The number of students in the classroom, motivation, and lack of technology*". Another teacher expressed T6: "*Sometimes there isn't any Internet connection in our*

school and some of my students haven't got any computers at home" in this regard. Another teacher said T13: "*Overstimulation or an addiction towards gameplay, chances are more for students to ignore other learning activities, lack of resources, subject fit*".

Table 4. Teachers' Opinions on the Main Barriers that prevent them to use Gamification in their Courses

Main Barriers	f
Lack of technology and internet	3
Encountering disciplinary problems in crowded classes	2
Lack of motivation	2
Students' apathy	2
Technical difficulties and problems in computerized games	2
Emergence of a noisy environment	1
Inability to prepare educational games suitable for every subject	1
Falling short of the lesson time	1
Lack of resources	1
Taking too much time	1
Causing addiction towards gameplay	1
Some students are not sufficiently involved in the process	1
Being prone to be tiring	1
Bringing about a negative competition environment	1

Discussion

In this section, the results of the research are discussed by comparing them with the critique of the literature review. Moreover, suggestions for future research are made based on the research findings. The purpose of this study is to explore teachers' opinions about the factors and barriers to adopting gamification in EFL teaching. In accordance with the research objectives, the opinions of a total of 16 English teachers working in public and private schools in Ukraine, and Turkey were obtained on this topic. The work experience of the participants varies from 0-14 years. It was also found that the participants have taught different grades.

As a result of the research, it was found that most teachers use gamification in their EFL teaching. Some teachers who participated in the research stated that gamification is very effective and important for their teaching and that they use gamification frequently in their course. Teachers use gamification in their course to make lessons fun, engage students, and ensure their participation in class activities. Furthermore, teachers use gamification in their course because it helps to motivate students, increase interest in learning, and support skill development. In addition, teachers report that they also prefer utilizing instructional games in their course, depending on the objectives of the lesson and the context of the subject. In their lessons, teachers generally prefer many gamification tools that include group activities, where students can practice the knowledge, they learned and make the lesson fun and interactive. Similar to our study, in the literature some of the teachers use digital games in their teaching and some use non-digital games (Talan, Doğan & Batdı, 2020). However, Alyaz and Akyıldız (2018) concluded

in their study that 3D digital games are not used enough in the foreign language learning process. Hazar (2018), on the other hand, found that teachers cannot use educational games appropriately in the classroom and they are inadequate in terms of instructional technology.

As a result of the research, it was found that teachers expressed many opinions about the most main factors that adopting the use of gamification in their classrooms. Teachers emphasized that games facilitate language learning, ensure active participation in class, make learning more enjoyable, and make the learning process effective and efficient. In addition, teachers indicated that gamification increases interest and attention to instruction and makes class time more productive by providing continuous motivation. Besides, games facilitate the development of students' language skills, make learning more enjoyable by making lessons interesting. The literature shows that gamification activities make teaching more effective by facilitating meaningful and permanent learning and increasing student interest, motivation, confidence, and participation in the course (Bai et al., 2012; Eltahir et al., 2021; Li, 2021; Talan, Doğan & Batdı, 2020).

In addition, it has been determined in the literature that games attract students' attention, facilitate the learning process and provide meaningful learning (Açış & Ayverdi, 2020; Çavuş & Balçın, 2017). Deubel (2006) also drew attention to the function of game-based learning in developing vocabulary skills and increasing mental quickness. It has been shown that playing games in the classroom has a positive effect on reducing anxiety and encouraging participation in speaking activities, increasing students' interest in the course and their ambition for success, which motivates them to play a more active role in classroom participation (Ebadi, Rasouli & Mohamadi, 2021; Grimshaw & Cardoso, 2018). In parallel with all these, the relevant literature has proven that educational games are effective in learner success, have a good effect on creating an interactive environment, and provide permanent learning and positive attitude development (Ashraf, Motlagh & Salami, 2014; Eltahir et al, 2021; Erol, Erdem & Akkaya, 2021; Mubaslat, 2012; Talan, Doğan & Batdı, 2020).

The results of the research show that there are barriers for teachers to adopting gamification in their EFL teaching. When examining teachers' opinions in this regard, it was found that factors such as the occurrence of problems such as irregularities, objections, and challenges during the game, the creation of a negative competitive environment, the extension of the time allotted for the game, and the creation of a noisy environment came to the fore. Negative aspects of gamification in the classroom also include that the games do not address the goal/topic, that some students are not engaged enough in the process, and that the teacher is tired at the end of the process. In addition, technical difficulties and problems with digital games, lack of technology and internet, technology, screen and game addiction, and health/psychological problems are some of the main reasons why teachers do not adopt gamification in their EFL teaching. Similar to the results of this study, negative situations have also been mentioned in some studies. Especially in the literature, it is claimed that problems such as disorder, noise, objections, criticism, and challenge may be encountered during the implementation of educational games in crowded classrooms (Bayram, 2015; Boden & Hart, 2018; Talan, Doğan & Batdı, 2020). Digital-based games can cause psychological problems, such as addiction, removal from social environment, and some health problems, such as eyestrain, headache, backache, sleep disturbance (Bilgin, 2015; Ellahi, Khalil & Akram, 2011; Talan & Kalınkara, 2020; Topçu, Küçük & Göktaş, 2014).

Furthermore, studies show that especially violent games individuals prone to violence in the long run (Hazar, Tekkurşun & Dalkıran, 2017). On the other hand, Alyaz and Genc (2016) noted that digital games are gaining more and more attention in language teaching, but their implementation is far from the expected and desired level due to technical, pedagogical, financial, and sociological obstacles. In addition, the literature mentions negative situations such as the lack of hardware infrastructure in the classroom, the difficulty of finding educational computer games that address the subject in the native language, the lack of game software for certain courses, the lack of technology, and the problem of internet connection (Demirbilek & Tamer, 2010; Ebadi, Rasouli & Mohamadi, 2021). Since the effective use of games can create productive learning results, it can be stated that such negative situations should be eliminated. For example, teachers should prefer games that are appropriate for the curriculum, facilitate complex problem solving, and address the development of more than one skill so that the games can be applied effectively in the classroom. It is thought that the selection of games considering characteristics such as grade of students, age group, educational content, and usefulness can create desired, productive, and enjoyable outcomes in the learning process. For games to be used effectively in the classroom, preference should be given to games that are aligned with curriculum, are entertaining and educational, are appropriate to the level of the students, and address the development of more than one skill.

The purpose of this study is to determine teachers' thoughts about the factors and barriers to adopting gamification in EFL teaching. It is hoped that the results of the study will contribute to the literature and be a resource for researchers. Further research could investigate the reasons why teachers do not use digital gamification tools more frequently in their classroom. In addition, researchers with an interest can investigate the impact on student attitudes, motivation, and achievement, as well as their psychological characteristics.

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Through the Lens of Students: How Online Discussion Forums Affect Students' Learning

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Through the Lens of Students: How Online Discussion Forums Affect Students' Learning

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Abstract

The current exploratory study investigated the perspectives of 13 students about the use of online discussion forums in a virtual English Language course at Sultan Qaboos University, Oman. A mixed methods approach utilizing self-report questionnaires, focus group interviews, and researcher observation was used to collect data. The study results showed that the majority of the participants viewed asynchronous discussion forums positively. Most importantly, the study revealed that participation in these forums enhanced various aspects of students' learning including critical reading, critical thinking and critical reflection skills, behavioral, emotional and cognitive engagement, as well as their social skills. On the other hand, the study results showed that online discussion forums were associated with several challenges. These findings have pedagogical implications on the design and implementation of these forums in the EFL field. The article calls for further research on online discussion forums in relation to students' level of study, academic achievement, and exam pass rates in various EFL courses.

Introduction

The spread of digital technologies in the last few decades, coupled with the proliferation of the Internet have influenced the way educators as well as learners conceptualize of and approach the teaching-learning process. Nowadays, educational institutions around the world encourage and support the integration of e-learning technologies in their educational systems (Al-Husban, 2020) in a learning age where web-based education has become ubiquitous (Dinc, 2017). Researchers believe that E-learning enhances students' overall learning experience. More specifically, Perdana, Jumadi, and Rosana (2019) argue that E-learning enhances students' higher order thinking skills such as analysis and argumentation. Furthermore, Lai (2016) posits that it impacts positively on students' academic performance through the flexibility it provides in terms of content and methodology as well as the personalized learning experience it offers (Al-Husban, 2020), as it makes catering for the individual students' needs and learning styles possible (Zanjani, 2015).

Online discussion forums (ODFs), accessible through a variety of Blackboard Learning Management Systems (LMS) such as Moodle, Edmodo, Educal and others, are considered one of the digital technologies that are used in virtual and blended learning environments and which could affect various aspects of students' learning. First, ODFs are considered an active learning-teaching approach; i.e., "an approach where learners participate in the

learning process by building knowledge and understanding" (Cambridge Assessment International Education, 2020, p. 1). In an active learning environment, students play an active role and take responsibility for their own learning. Thus, it is believed that the systematic integration of ODFs in online and blended learning environments in various fields of study brings about several learning gains. According to Lyu (2018), ODFs enhance the EFL learners' learning experience considerably. In particular, Biriyai and Thomas (2014) argue that increased student participation is one of the immediate benefits of participating in ODFs. First, when compared to a traditional classroom discussion which requires instant replies from the students, asynchronous online discussions are more flexible as the student is given ample time to reflect on his/her answers before posting them for others to read. The flexible nature of the ODFs ultimately affects the frequency as well as the quality of students' responses positively. Moreover, an online discussion platform constitutes a valuable opportunity for the shy and reserved students to contribute their opinions about a variety of topics, which boosts their confidence and promotes their learning (Onyema, Deborah, AlSayed, Naveed, & Sanober, 2019).

In addition to increased student participation, it is argued that ODFs influence interaction and communication between students themselves and between students and the teacher significantly (Biriyai & Thomas, 2014). According to Dang and Robertson (2010), these forums "shape students' social relationships and identity" (p. 8). The ODF participants often negotiate friendship with other like-minded participants. They often read and comment on their discussion postings and seek to build friendship with them outside the teaching-learning context.

Furthermore, in ODFs learners become active participants and take ownership of their own learning as they make decisions about the postings to read, the questions to ask, and the comments to post, among other tasks a discussion requires (Harris & Sander, 2007). Added to that, researchers including Li and Liu (2018) and Lyu (2018) maintained that participation in ODFs facilitates English language acquisition, especially the development of reading and writing capacities. For instance, a study carried out by Miyazoe and Anderson (2012) showed a qualitative change in the participants' writing styles. Another study conducted by Akmal (2017) revealed that the content, organization, lexis, syntax, and writing mechanics of students' writing improved considerably as they took part in ODFs.

The reviewed literature above emphasizes the potential benefits of integrating ODFs as an active approach in the learning-teaching process. However, research in this area in the context of Oman is relatively scarce. Furthermore, EFL studies that explore the utilization of ODFs in learning are extremely limited. One possible reason for the reluctance of EFL teachers to adopt this approach in the current context of study is the challenges associated with designing, monitoring, and evaluating student participation in such forums (Murphy & Coleman, 2004). Another possible explanation is that asynchronous discussions, as an active learning technique, are more suitable and effective in Western educational settings where, unlike the Arab world, students are more accustomed to active learning methods. Thus, the aim of this exploratory study is to address the following research questions:

- What are the students' overall perceptions of ODFs?
- How do students perceive the learning gains of participating in ODFs?
- What are the students' perceptions of the challenges faced when participating in ODFs?

Method

Study Participants

The current study utilized purposive sampling to recruit the participants. This sampling technique is widely used in higher education research in general and EFL research in particular (Dörnyei, 2007; Gray, 2014). Only students who have experienced participating in an online discussion forum would be "information rich" and would, therefore, be able to "best provide insight into the research questions" (Emmel, 2013, p. 33). Thus, the participants were selected based on their accessibility. After explaining the study's purpose to the potential participants and assuring them of the confidentiality of the data they would provide, 13 students agreed to take part in the study. Except for three, all the participants were Omanis with 39% males and 61% females. About 62% of the participants were aged 35 or above, 31% aged between 30 and 35, and 7% were aged below 30. About 54% of them were studying in full-time mode, while 46% were studying part-time. All the participants were enrolled in an English Language Skills course offered to prospective PhD students. The successful completion of the course is required to enroll in any doctorate courses offered by various colleges at Sultan Qaboos University. The participants belonged to six different pathways; namely, Art (4 students), Engineering (3 students), Agriculture (2 students), Medicine (2 students), Commerce (1 student), and Science (1 student).

Study Design

The study adopts a mixed methods design, which is considered the best design to adopt where time constraints might limit access to the participants, as is the case of the current study where access to the participants is limited to 15 weeks. Creswell (2009) argues that this particular design is the most suitable to adopt in order to obtain substantial data that results not only in well-validated but also substantiated findings. Therefore, the study utilizes a concurrent triangulation design which involves the collection and analysis of both quantitative and qualitative data simultaneously. The findings were mixed in the interpretation stage. This design particularly helped validate and corroborate the study's findings (Creswell, Plano Clark, Gutmann, & Hanson, 2003).

First, data was collected through a self-report questionnaire that was administered in week 15. According to Fredricks and McColskey (2012) and Scott and Morrison (2007), self-reports are not only convenient and practical but also allow the collection of more inclusive data. The survey used in this study aimed to gather data about the participants' overall impressions about their participation in ODFs in the course, and more specifically, about the potential benefits of such learning approach. The questionnaire comprised of 40 questions divided into four major parts, in addition to four demographic questions about nationality, gender, age group, and study mode. The four parts aimed to examine the students' opinions about their overall learning experience, perceived learning gains, and potential challenges of participating in such ODFs. A 6-point Likert scale ranging from 'Strongly Agree' to 'Strongly Disagree' was used to measure the questionnaire items.

Along with the self-report questionnaire, data was collected through teacher observation of student participation in the forums. The observations were focused on the frequency and quality of the postings and were recorded biweekly. Data gathered through the questionnaires and observations were complementary (Renninger &

Bachrach, 2015).

Another data collection tool used in the study was semi-structured focus group interviews. The purpose of the discussions was to understand how the participants actually perceived the gains and challenges associated with ODFs' participation and the reasons behind those perceptions. Thus, addressing the 'how' and 'why' behind the participants' views was enabled through these discussions (Turner & Meyer, 2000). In week 15, an email was sent to all the potential participants inviting them to take part in the focus group interviews. Eight students volunteered to be interviewed and three discussion sessions were held on three different days for this purpose. Each discussion lasted about 60 minutes, and was audio-recorded and transcribed immediately after the interviews.

Data Analysis

Descriptive statistics were used to describe students' distribution across nationality, gender, age, and study mode by computing the frequencies and percentages. The mean scores were also calculated to decide the average score and the range of responses. The qualitative data collected through the focus group interviews was analyzed using an interactive model advocated by Miles and Humberman (1994), which consisted of three main processes; namely, data reduction, data display, and drawing and verifying conclusions. The first stage involved an initial coding activity, which allowed the development of a general sense of the data. An inferential coding scheme was employed in the second stage in order to identify patterns and recurrent themes. In the last stage, the connection between the various themes was established and comparisons were made in order to draw conclusions and answer the research questions.

The Online Discussion Forums Design

The English Language Skills course is offered to prospective PhD students who receive a band score six in the IELTs (International English Language Testing System) exam. The course intends to enhance students' reading, writing, research, and study skills. The online discussion is a non-graded course component and is a platform to discuss various topics related to the textbook themes. These discussions are well structured and held systematically every two weeks, which is the allotted time to cover each theme. Each discussion consists of several stages.

First, on the first day of the week, the teacher posts a discussion topic on the LMS Moodle. The following are examples of such questions: 'Do you think that Emotional Intelligence is the most important of the multiple intelligences of human beings?' and 'Do you agree that a socio-scientific issue-based research approach promotes critical thinking?' In the second stage, students write a 110-word long response to the discussion topic and post it on the forum. Limiting the length of students' writing to a 110 words was meant not only to reduce the stress that longer writings might cause to students, but also to help students remain focused on the arguments they use. Once students post their initial response on the forum, they read each other's contributions and select two postings to respond to them. Next, they write a reply to each of the selected posts. In their replies, students show their agreement or disagreement with the selected ideas, elaborate on and provide supporting ideas to a certain argument, and/or ask questions to their peers, etc. The last stage in the process involves responding to comments

from peers if a student receives any. This stage particularly aims to enhance the interactive nature of such discussions.

Results and Discussion

Students' Overall Perceptions of ODFs

The first question the study posed focused on the students' overall impression about participating in ODFs. The study showed that the large majority of the study participants (93%) viewed taking part in these discussions positively and considered it a new experience that introduced them to a novel teaching-learning technique and methodology, as at that time only one study participant had experienced taking part in similar discussions at an undergraduate study level. This finding emphasizes the fact that educators in the Omani context shy away from integrating this approach in teaching possibly due to the difficulties entailed in planning, monitoring, and assessing such forums (Murphy & Coleman, 2004; Seethamraju, 2014). The study participants described this technique as "interesting" (MAM8), "effective" (BGF2), "very useful" (MAM8), and "beneficial" (JAF5). Above all, one interviewee considered it as the "most comprehensive learning experience" and "the most interesting thing in the course" (JAF5). This finding contradicts with previous claims that, as an active teaching-learning approach, ODFs might not be effective in a non-Western educational setting like Oman (Nguyena, Terlouw, & Pilot, 2006). On the other hand, this finding aligns well with Hamann, Pollock, and Wilson's (2012) study results, which showed that students consider ODFs the best platform where they can express their thoughts, and consequently, consider it an invaluable learning experience. Although students' overall impressions about ODFs are positive, the way the discussion is structured might have an impact on students' perceptions. For instance, one of the interviewees expressed her dissatisfaction with the ODFs' structure saying, "I think the main idea is ok, but it is not the final way it could be used in the education field." (FSF6). Afify (2019), Hamann, Pollock and Wilson (2012), and Seethamraju (2014) pointed out that several factors contribute to the effectiveness of an ODF. Among such factors there is student preferences (e.g. face-to-face versus online), discussion design (e.g. group size, topics, discussion structure), delivery strategies (e.g. teacher involvement), purpose (e.g. graded versus non-graded), etc. Consequently, EFL teachers who are interested in this approach might negotiate these design features with their students to win their buy-in.

Learning Gains of Participating in ODFs

In addition to exploring the participants' overall perceptions of the utilization of ODFs as a teaching and learning tool in the course, the study sought to investigate how the participants perceived the learning gains of taking part in the ODFs.

Enhancement of the Participants' Critical Reading Skills

Primarily, the study revealed that ODFs enabled students to enhance their reading skills in general and critical reading skills in particular. Critical reading is defined as "the process of evaluating the authenticity and validity of material and of formulating an opinion about it." (Demiroz, 2007). All the respondents indicated that, before

they contributed their answers to the forum, they tried to define the discussion topics clearly to ensure they have understood the topic well. This was achieved through various means like conducting extensive and intensive internet research to learn more about the topic. For instance, one of the interviewees explained this saying "I really search for the information, well understand it, and when I have the idea built in my mind that is the time when I write…" (FSF6). Another interviewee emphasized this idea saying, "I should gather more information about the topic especially from scientific journals…I should include some scientific evidence to support my opinion" (MAM8). Although 54% of the respondents indicated that they did not directly ask for clarification from the teacher and other students when faced with difficulties, they explained that they enhanced their understanding of the topic by reading other students' postings. One of the discussion participants explained this idea saying, "I used to post my work late. I read most of my colleagues' posts, then I understand more details about my post" (MSM7). Along with developing a deep understanding of the topic through various means, the majority of the study participants (93%) claimed that they evaluated information in the forums and compared any concepts the participants discussed. One of the interviewees said, "Actually, I read these ideas more than one time to analyze what they mean and what their purpose is in order to argue and to understand how to reply" (MSM7). In fact, the study participants indicated that the forums engaged them in higher order thinking skills like analysis and evaluation. Upon asking them about the basis for selecting postings to comment on, one of the interviewees replied, "We need to critically analyze what our colleagues are saying. Sometimes, initially, they could be saying something similar to us, but some points they mention could be different from our views and sometimes could be the counter argument of our views" (JAF5). Another participant explained, "I evaluate other students' beliefs, especially when I discuss topics important for human beings…I evaluate information as well and the proof or evidence they use to support their answer" (MSM7). Another interviewee emphasized the need to read the discussion posts critically before replying to any of them saying, "How I choose some of them and reply to them may be that requires analyzing the posts". Another interviewee emphasized this idea saying, "This is like a practice for how to evaluate information from different sources…I have to read deeply and understand how the person thinks. This helps me a lot to evaluate information in the forum" (AHF1). Thus, analysis and evaluation formed the basis on which students selected postings to respond to by commenting, elaborating, and or critiquing them.

Enhancement of the Participants' Critical Thinking Skills

In addition to critical reading, the respondents reported that the ODFs enhanced their critical thinking capacities considerably. This study considers critical thinking an extension of critical reading and conceptualizes it as a construct that consists of the "component skills of analyzing arguments, making inferences, using inductive or deductive reasoning, judging or evaluating, and making decisions or solving problems" (Lai, 2011, p. 2). The vast majority of the study participants (93%) claimed that the ODFs allowed them to think deeply about the topic and their ideas, and they ensured that they gathered sufficient and relevant information from multiple sources so that they could post effective and useful information in the forum and provide strong and relevant arguments when commenting on their peers' postings. One interviewee highlighted this idea saying, "It encouraged me to think deeply because while discussing something with others, you have to give the best information you have." (BGF2). About 93% of the participants claimed that in addition to searching for additional resources, they tried their best to combine various ideas in the forum in a logical order by relating new information to what they already know and 77% of them reported keeping track of their own understanding. One of the discussion participants described

this process saying, “I read these ideas more than one time to analyze what they mean, what their purpose is and to understand how to reply and how to argue for or against them” (MSM7). Engaging in deep thinking processes influenced the quality of the participants’ initial postings as well as their comments on their peers’ postings.

This study finding aligns with results from previous studies that investigated the impact of ODF participation on students’ critical thinking capacities. For instance, a study carried out by Fitriana and Anggial (2016), which involved 26 students enrolled in a Speaking II class at Bandar Lampung University, Indonesia, showed that participants in such forums were able to advance their thinking processes by researching information about the discussion topics, reading and evaluating postings from peers, and being critical when responding in the forum. Similarly, Jacob (2012) argued that ODFs enhance students’ critical thinking capacities in a slow, but steady manner, especially if the instructor efficiently supervises the forum. On the other hand, a study conducted by Al-Husban (2020) showed that ODFs might not enhance all aspects of students’ critical thinking skills in the same manner. For instance, using Newman’s indicators of critical thinking, her study showed that the relevance and importance of students’ postings were enhanced in ODFs; however, justification and critical assessment were not. Using Garrison’s critical thinking model, however, the study participants could recognize and explore problems, but their ability to evaluate the problem and integrate solutions into their existing knowledge was underdeveloped. Therefore, it is extremely important for teachers to design such ODFs carefully and to monitor them closely to maximize their benefit for the participants while focusing on the skills they would like these participants to develop.

Another interesting finding of the current study is that ODFs enhance the participants’ critical reflection skills. According to Hickson (2011), critical reflection involves analyzing and critiquing the assumptions on which our beliefs and values are based. The current study revealed that the ODFs provided many students with a valuable opportunity to reflect on and evaluate their writing skills as well as their thinking processes. For instance, one of the interviewees explained, “When I read my colleagues’ posts, I sometimes see opinions and ideas better than what I have. It helps me to define my weaknesses or which aspect of my writing I should focus on or work on in the future” (MNF4). Similarly, one interviewee explained, “Sometimes students write and elaborate more about the topic and critically think about the topic more than I do. So when I compare my writing with them, I can see where my weaknesses are and later I need to overcome them” (JAF5). Receiving comments from peers was also another interesting aspect of the discussion that led some students to reflect on their long-held beliefs and assumptions and at times to change their views because of the strong arguments their peers provided. One participant explained, “When we see others’ replies, we can grasp the deficiency in our understanding…I can compare how they understand and how I understand the same topic” (JAF5). In fact, one of the interviewees described how participating in ODFs influenced her attitude towards communication with others through reflection saying, “It opened my eyes to improve my discussion skills…I think I must research for ways to develop and find the best way to communicate with others and develop my skills” (FSF8). Another study participant confirmed that participating in these forums led her to reconsider her beliefs about making mistakes and language learning in general. She said, “The discussion forum gave me the chance to see others’ writings, ideas, and mistakes. It helped me to realize that mistakes are something usual and normal to learn. Even others who we think are perfect, they make mistakes”. She added, “Before, in English language courses, I feared to participate and to

make mistakes. I think this put me in a bad situation…When you accept that you make mistakes, I think that your learning chances will be better and faster." (MNF4).

Although research that explores the impact of ODFs on students' reflective thinking in the EFL field is scarce, results from studies conducted in other fields such as medicine, information technology, political science, and accounting, etc. confirm this study's finding. For instance, a study conducted by Chadha (2017) which involved 87 students enrolled in several upper- and lower-division political science courses showed that involving the participants in interactive weekly discussions, especially in a collaborative online or blended learning environment, engaged them in academic reflective practice. Curtis (2006) also emphasized that ODFs constitute an excellent opportunity for participants to examine their assumptions and beliefs about various aspects of their lives, including academic and professional life. In fact, Seethamraju (2014) believes that ODFs foster "dialogue, reflection, knowledge construction, and self-assessment" (p. 2). Other researchers like Jabbari, Mohammadi, and Fazilatfar (2017) also pointed out that the participants' involvement with learning tasks and contributions are enhanced in ODFs. However, it should be noted here that if the instructor does not encourage the participants to engage actively in the reflective process, to attach multiple meanings to various lived experiences, and to reflect on the origin of their own beliefs, this opportunity could be squandered. This emphasizes the crucial guiding role that instructors play in achieving the desired positive outcomes.

Another positive impact the current study showed is the enhancement of students' engagement at the behavioral, emotional, and cognitive levels in ODFs. Behaviorally, the respondents claimed that their participation increased, as 85% of them reported taking part in all the discussion forums, reading almost all other students' discussion posts, and replying to more than two posts in each discussion thread. This was confirmed by the researcher's observation of the students' contributions to the forum and was emphasized by many of the interviewees during the discussions. For example, one of the participants said, "When I receive the notification that someone posted on the forum, I immediately check what they wrote" (FSF6). Another interviewee explained her enthusiasm to read other students' posts saying, "Because I don't want to miss others' opinion, I read all discussions before I start the new week and we start discussing a new topic" (AHF1). In fact, one of the discussion participants believed that reading these posts was an interesting aspect of the discussion. She said, "I think it is more interesting, and more useful than writing my posts…I already know my ideas and opinions, so what is really useful is to know what others' opinions are, what they say, and their writing" (MNF4). The students' increased participation could be attributed to the flexible nature of asynchronous online discussions and ample time given to them to post their ideas on the forum. In fact, Biriyai and Thomas (2014) argue that their study showed that flexibility was a powerful motivator for their students to take part in the discussions. Thus, a two-week time period is the recommended time period allotted to discuss a specific topic to maximize students' participation and enhance the quality of the postings.

Along with the improved participation, the current study revealed that the effort the participants put in the discussions increased considerably, which influenced the quality of their postings positively. About 93% of the respondents reported making an effort to write good-quality initial posts and replies by reading more and searching for new information. One possible explanation for the increased effort in the current study could be the

controversial nature of the discussion questions, as before forming an opinion the participants should understand the topic thoroughly and consider different arguments they would use to support their viewpoint carefully. Afify (2019) argued that the discussion topic is one of the factors that might influence students' performance in a forum and the effectiveness of the discussion positively or negatively. He emphasized that a key feature is to base a discussion question on higher rather than lower order of thinking to encourage deep rather than superficial discussions. Another possible reason for the increased effort could be the fear of losing face. One interviewee said, "When you know that others will see your work, it should be good, it should be perfect" (AZ73). Another interviewee added, "I should provide evidence, not just agree or disagree based on my experience. My experience is important, but it might not be correct" (MAM8). Similarly, another participant highlighted the need to post good quality discussion contributions saying, "When discussing something with others, you have to give the best information you have. You should have enough information and read more about the topic, not just have basic information" (BGF2). In fact, many of the study participants believed that those postings contributed greatly to the image that other participants would have about them. One of the interviewees stressed this idea saying, "As a PhD student, from a psychological point of view, I think I should be perfect. Everything should be perfect in reading and writing" (MAM8). This finding indicates that social embarrassment and losing face are still considered major concerns for many students in the Arab Gulf states like Oman despite the claims of researchers like Al-Harthi (2005) who contended that the 'shame culture' is reduced in online learning environments in these countries. In fact, Li and Liu (2018) warned that the discussion forum could be viewed as a burden for some students due to the fear of appearing silly when making errors. Since this feeling could have debilitating effects on students' performance, instructors should help students overcome this fear by ensuring that the discussion environment is encouraging and non-threatening for all the participants through positive feedback and engagement with students in the forum.

Emotionally, the study revealed that ODFs triggered both positive and negative feelings in the study participants depending on the task performed. On the one hand, the majority of the participants (85%) reported enjoying the discussions; more specifically, most of them (93%) enjoyed writing their initial posts. The feeling of interest and enjoyment could be attributed to the participants' desire to share ideas with peers, to contribute knowledge to the forum, and to interact with others. For instance, one of the interviewees considered the first task of posting responses to a discussion topic a valuable opportunity to expand her knowledge about the topic, exchange ideas with other participants, and to learn from others (AZF3). Another interviewee described his opinion saying, "I want to express my opinion because I have already read about the topic and I have evidence. I like to provide my own perceptions. This is interesting for me because I want to know what other students think of my opinion" (MSM7). Another participant, however, considered it a challenge that she had to face bravely. She said, "I like the idea of challenge and those were critical thinking not normal questions. You have to give evidence to defend your argument. I love that" (FSF6). Furthermore, 83% of the respondents reported their interest in reading other participants' posts more. One of the interviewees considered it the best aspect of the discussion since it helped her learn about her peers' ideas and writing style (MNF4).

On the other hand, 23% of the study participants reported feeling unhappy and scared to participate in the forum, more specifically to comment on peers' postings. These negative feelings were triggered by the discomfort the

participants felt providing negative comments about their peers' posts. For instance, one of the interviewees explained, "Some students felt fear, not fear but embarrassed to say 'I don't agree with you' because all other students will see my comment against him. So may be that student will not participate again" and added, "I don't like to reply against them and say to them this is not correct or wrong…May be he/she will be embarrassed. Also because you know, people don't like it when somebody says you are wrong to them or disagrees with them" (MAM8). Another student further explained, "I don't like the idea. I feel I am afraid to hurt them or say something they might get angry or disappointed. It's better for me not to say" (FSF6). Thus, when asked about the basis on which they selected posts to respond to, one of the interviewees explained, "I choose someone who agrees with me. I mostly replied to people who agreed with me because we have the same beliefs and mind sets" (MSM7). In fact, only 69% of the survey respondents reported that they tried to include information that opposes the argued position when replying to others' posts, compared with 93% who claimed they included information that supported the argued position. The reluctance to criticize others' postings was also observed by the researcher in the participants' replies which were dominated by phrases that express agreement (85%) like 'I agree with you', 'You are right', 'I am interested in your post', and 'I totally agree with you' compared with phrases showing disagreement. Receiving comments that contradicted with their own beliefs and assumptions as well as criticism about various aspects of their postings also caused negative feelings in some participants. One of the interviewees described this saying, "We need to reply to each other. This reply may sometimes cause anxiety, a feeling of anger because they reply to your post in a negative way" (JAF5).

This study result aligns with findings from previous research which showed that students' participation in ODFs is largely influenced by several cultural dimensions (Onyema et al., 2019). For example, collectivist cultures, which generally pertain to the Arab society, value homogeneity among various groups. This is why people in these societies are often integrated into strong and cohesive groups that view criticism negatively. Consequently, discussion participants belonging to these cultures tend to avoid criticizing others' posts and feel embarrassed and even offended if they receive criticism from peers (Lyu, 2018). Therefore, ODFs in these educational settings might encourage harmony instead of debate, thus resulting in poor quality discussions (Lyu, 2018). Educators operating in these educational settings should consider this critical factor and encourage the discussion participants to overcome this obstacle by highlighting the positive impact of deep discussions and constructive criticism on their learning as well as academic and professional growth.

The current study also revealed that cognitive engagement is enhanced in ODFs. According to Rotgans and Schmidt (2011), cognitive engagement is "the extent to which students' are willing and able to take on the learning task at hand. This includes the amount of effort students are willing to invest in working on the task and how long they persist" (p. 467). Most of the participants in the current study (93%) reported that they persevered and invested a lot of effort in the various stages of the discussion. Prior to the discussion, almost all the participants (93%) emphasized that they searched the Internet for additional sources of information not only to understand the topic better, but also to select the best arguments they would use to support their point of view. While writing, their initial posts, all the participants stressed the amount of effort that they put in order to produce a good quality writing. One of the interviewees described this process saying, "I write a draft first, and then I go through the text or writing twice. Then, to be honest, I compare it with others and what they wrote, may be I missed something…I

check if I satisfied all the requirements of the question in my answer. Then I proofread it. After that, I post it" (JAF5). After they have posted their initial posts, the participants also reported putting effort in reading other participants' postings, analyzing and evaluating them, selecting posts to respond to, and writing their comments and replies. These tasks engaged the participants in higher order thinking skills and enhanced their cognitive engagement considerably. Simultaneously, various decisions that the participants had to make throughout the discussion stages also encouraged them to take ownership of their own learning and enhanced their autonomy. This study finding aligns with those highlighted by Cothran and Ennis (2000) and Sherab (2013) who believe that the participants' engagement in active learning scenarios has a positive impact on their cognitive engagement. According to Dang and Robertson (2010) and Harris and Sander (2007), being an active learning approach, ODFs promote confidence and consequently increase learner autonomy and engagement in learning.

In addition, the current study revealed that the students' participation in ODFs enhanced their social skills. According to the participants, taking part in these discussions particularly boosted their written communication skills. Most of them claimed that they learned how to respond to others in a direct and focused way, and most importantly, in a polite and non-offensive manner. One of the interviewees explained, "If you don't agree with someone, how you write it? I have to use the right words. Even if I disagree, I have to put it in a polite way" (BGF2). Another interviewee commented, "Because we are replying to others, we have to write in a polite way because we don't want to write 'No, I don't agree' or express the counterargument in a way that makes the other person nervous or he/she does not like what we said. So we have to be polite" (JAF5). This can be explained by the high-context, collectivist culture of the Omani society which cherishes unity and harmony and values politeness considerably (Mujtaba, Khanfar, & Khanfar, 2009).

The participants also claimed that the ODFs developed their argumentation skills, which are crucial for their personal and academic success. One of the interviewees explained, "You need to answer and convince others because this is a real-life task. We have this kind of discussion in our life, at home, at work… It happens. Different people have different perspectives" (MSM7). Another interviewee added, "We improved one skill, how we convince others with our point of view in a scientific way because as researchers all our future is about discussions, debate and sharing information" (MAM8).

The ODFs also constituted an excellent opportunity for the participants to build relationships with others in the group, especially that the course was offered online and the students had never had the chance to meet each other face-to-face. For instance, one of the interviewees expressed this idea saying, "When I reply to X, I know what she is thinking…when she replies, I feel we are like friends" (JAF5). According to some of the participants, this led to further collaboration between them. For instance, one interviewee explained the reason he would comment on posts that align with his own opinion saying, "You need to have a link with your colleagues. We agree about the same point, so it will be more helpful. Actually, we can increase our knowledge. That happened with one of my colleagues X. He gave me more information, evidence, proofs from scientific research related to my major" (MSM7). In fact, this finding is in agreement with Dang and Robertson's (2010) finding which showed that online communication shapes both students' social relationships and identity, as they negotiate friendship with like-minded participants by reading and commenting on their postings. It also aligns with Onyema et al. (2019) whose

research showed that improved communication and relationship between the discussion participants is one of the immediate positive impacts of ODFs, which ultimately helps them develop a sense of a learning community outside the classroom (Li & Liu, 2018).

Challenges and Pedagogical Implications

The third question the current study posed was how the participants perceived the challenges accompanying participation in ODFs. The study revealed that participants in the current study faced three main challenges. According to 62% of the respondents, time was considered the major challenge associated with ODFs. The respondents reported the difficulty they faced writing effective posts and reading others postings on the forum thoroughly due to time constraints, especially during the exam period and towards the end of the semester. For instance, one of the interviewees described the way her participation was affected saying, "Once we came to the end of the semester, we had many assignments to submit and, actually, I delayed posting my discussion and delayed reading others' postings" (AZF3). Another interviewee expressed the same concern saying, "We are in the end of the semester and we have a lot of assignments to do. That is what makes me sometimes want to finish it as soon as possible to get started with other assignments" and she added, "This makes it less effective" (MNF4). This finding has a major implication for the design and application of this learning approach in the EFL field, especially if ODFs are a graded course component. To avoid this issue, the discussion could be put on hold during busy times like the mid-term exam period. Moreover, the discussion could be ended one or two weeks before the academic semester ends in order to avoid low student participation, bad quality posts, and to relieve the stress that these discussions could cause in some students during those stressful times.

One unanticipated finding was that some of the participants considered dealing with others' writings a major challenge. About 38% of the respondents reported that their only concern when reading others' post was to finish reading them rather than thoroughly understand them. Moreover, 54% reported that they did not ask for clarification when faced with difficulties to understand information written by other participants. There are many possible explanations for this, including the time constraints and shyness of some of the participants. However, many interviewees highlighted the quality of the students' writing as a major cause for this behavior. Describing this challenge, one interviewee said, "When I try to read my colleagues' writing, I face some challenges understanding the language, the way they write and express ideas. It was not that clear. So, it bothers me and annoys me and I sometimes don't continue reading because the ideas aren't well prepared or not well presented" (FSF6). Another interviewee stressed another aspect of this challenge saying, "Some people share their opinion in a difficult way. So I find it difficult and I need more time to understand their opinion" (AHF1). This particular finding is inconsistent with results from other studies which advocate ODFs as a learning approach that improves students' writing considerably (Akmal, 2017; Miyazoe & Anderson, 2012), and it suggests that ODFs might not have a similar impact on various aspects of students' writing. For instance, this finding suggests that ODFs might enhance students' writing in terms of content and organization of ideas but not in terms of syntax and grammar, which vary according to the students' linguistic proficiency. One major implication of this finding is to choose the student population to participate in ODFs carefully, as participating in these forums could disadvantage students with low linguistic proficiency. Moreover, the instructor should identify a suitable way to monitor the

quality of students' postings to enhance their readability. One possible way is to provide feedback to students before they post their writings on the forum.

Researchers like Al-Husban (2020) and Lai (2016) argued that the flexible nature of the ODFs facilitates interaction between the participants. However, contrary to this expectation, the current study showed that this aspect of ODFs could be counterproductive and could have negative effects on students' participation. Many of the discussion participants emphasized that the time delay between uploading the initial posts on the LMS and receiving comments about them constituted a challenge for them. One of the interviewees commented, "The challenge was waiting for a reply from others because they don't write at the same time. I write something, and at that time I am free and waiting for others to write and share ideas, but no one is there at that time". She added, "Sometimes you might miss the response of others and their opinions if they respond after a long time" (BGF2). This particular issue could influence the interactive nature of the discussions negatively by demotivating enthusiastic and fast students. To overcome this issue, synchronous online discussions could be used instead of asynchronous discussions, although this might compromise on the depth and breadth of the discussions since students will not have sufficient time to search for information and elaborate on their ideas. Instructors, however, could set deadlines for each of the discussion tasks in the instructions in order to avoid last minute contributions that the majority of the discussion participants could miss.

Conclusion

The current study explored the students' perspectives about the use of ODFs as a teaching-learning approach in an online English language course. The study revealed that this approach brings about several learning gains although there could be several challenges associated with it. On the one hand, this approach to learning enhances students' ability to read and think critically about various aspects of the discussion such as the information presented and writing style. This study also showed that critical reflection is also enhanced as students reflect on their long-held beliefs and assumptions about different topics as well as their learning experience. Furthermore, the ODFs contributed to students' engagement positively leading to increased behavioral, emotional and cognitive engagement in the learning process. Another positive impact of ODFs the study showed is the enhancement of students' social skills. Conversely, several challenges could be associated with ODFs like time constraints, which could influence the students' participation negatively, the participants' poor linguistic proficiency, which could disadvantage both the good and the low-level students, and the flexible nature of the discussion, which could be counterproductive if not controlled.

The study findings have pedagogical implications and implications for future research in the field of English as foreign language teaching. Most importantly, ODFs emerge as an effective instructional tool that is worthy of exploration in the context of Oman. Thus, research studies that investigate the way different EFL student groups interact in these forums are vital. The exploration of other aspects of students' learning such as exam pass rates and academic achievement in relation to participation in ODFs is equally important.

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