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Deanship of Scientific Research

High School Teachers' Views on E-Learning Implementation Barriers During the COVID-19 Pandemic in Ramallah and Al-Bireh Directorate

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Abstract

Objectives: This study investigates the e-learning barriers experienced by Palestinian high school mathematics and science teachers in Ramallah and Al-Bireh Directorate amid the COVID-19 pandemic and assesses the differences in teachers' views of these barriers.

Methods: A Stratified random sample that consisted of (104) participants from Ramallah and Al Bireh Directorate was recruited. Electronic questionnaires were used, and the descriptive statistical analysis was conducted to answer the research questions. The mean and standard deviations of responses for all the barrier options were calculated. An independent t-test and ANOVA were employed to examine differences between barriers according to the participants' perceptions. The Scheffé test was also used to examine the differences between groups.

Results: The findings showed that the level of barriers was high ,with the highest barriers being at the students 'level ,followed by the curriculum level .The study found no statistically significant effect of specialization on the levels of barriers at school, curriculum ,or academic qualifications.

Conclusions: This research highlights the importance of overcoming learning barriers while maximizing the benefits of e-learning, emphasizing the significance of teachers' views during and after the pandemic.

Keywords: Barriers of e-learning, views, high school teachers.

آراء معلمي المدارس الثانوية حول معيقات تطبيق التعلم الإلكتروني خلال جائحة كورونا في مديرية رام والبيرة

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ملخّص

الأهداف: هدفت هذه الدراسة إلى تقصي آراء معلمي الرياضيات والعلوم في المدارس الثانوية في مديرية رام الله والبيرة حول معيقات تطبيق التعلم الإلكتروني خلال جائحة كورونا، وتقييم الاختلاف في وجهات نظر المعلمين والمعلمات حول هذه المعيقات.

المنهجية: تعتبر هذه الدراسة دراسة مسحية كمية، حيث تم اختيار عينة عشوائية طبقية مكونة من 104 معلم ومعلمة من مديرية رام الله والبيرة، واستخدمت الاستبانة الإلكترونية كأداة للدراسة . أجري التحليل الإحصائي الوصفي للإجابة عن أسئلة الدراسة، حيث حسبت المتوسطات الحسابية والانحرافات المعيارية لإجابات المبحوثين وعرضت في جداول، كما تم حساب اختبار t المستقل واختبار ANOVA لفحص الاختلافات في المعيقات وفقاً لإجابات المبحوثين، واستخدم اختبار شافيه لفحص الاختلافات بين المجموعات.

النتائج: أظهرت النتائج أن المعيق الأكبر كان يتعلق بالمعيقات الخاصة بالطلبة، يليها المعيقات المتعلقة بالمناهج، وأظهرت النتائج عدم وجود فروق ذات دلالة إحصائية لمتغيرات التخصص في المعيقات المتعلقة بالمدرسة والمنهاج والمؤهل العلمي.

الخلاصة: زاد هذا البحث النقاش حول كيفية التغلب على معيقات التعلّم، من خلال زيادة الفوائد من التعلم الإلكتروني، وإظهار أهمية الأخذ بآراء المعلمين خلال وبعد الجائحة.

الكلمات الدالة :معيقات التعلم الإلكتروني، آراء..

INTRODUCTION

China reported a cluster of cases of COVID-19 on 31 Dec 2019in Wuhan, where the novel corona virus was eventually identified, so The World Health Organisation (WHO) announced that COVID-19 was becoming a danger on 30th January 2020. On 11th March 2020, deeply concerned both by the alarming levels of spread and severity and by the alarming levels of inaction, WHO made the assessment that COVID-19 could be characterized as a pandemic and issued a consolidated package of guidance covering the preparedness, readiness and response actions for four different transmission scenarios: no cases, sporadic cases, clusters of cases and community transmission (WHO,2020).

While the Corona virus (COVID-19) is rapidly spreading over the world, killing over 3000 people, many countries have taken steps to restrict the transmission, including closing schools. According to UNESCO, 46 countries throughout the globe have recorded school cancellations to combat the spread of COVID-19, which began on March 12th. 26 countries have closed all of their schools. across the country, Having an impact on the learning cycles of about 376.9 million children and young people who may otherwise attend school. In total, over 500 million children and teens have had their education jeopardized as a result of their failure to attend school (Huang et al., 2020).

To contain the outbreak, the Palestinian government released a plan on March 9th outlining strategic measures for a number of key sectors, including health, economy, and social protection, as well as closing schools, universities, and higher educational institutes while encouraging students to study from home.

The Palestinian Ministry of Education launched the distance education path to preserve the educational community's vital process and interconnectedness, as well as to provide a large space for its constituents to make the COVID-19 challenge an opportunity to unleash creativity, innovation, and leadership in various aspects of educational work. The ministry has dealt with the changing circumstances, and the education and learning process has been administered remotely through the use of information and communication technologies (ICT) (Ministry of Education,2020a).

In June, the Palestinian Ministry of Education began training teachers on a variety of online tools, including Google Forms, Google Teams, Quizzes, and the ADDIE framework (i.e., analyse, design, development, implementation, and evaluation), in order to improve their ability to design educational materials inorder to assist students and teachers in learning from home (Ministry of Education, 2020b).

Many research on e-learning implementation difficulties were carried out in the absence of COVID-19, which had an impact on the goals, tactics, tools, resources, and applications of e-learning. Many schools and universities have recently used e-learning or online learning, according to Zaharah & Kirilo-va(2020), but not all of them had the choice to do so due to limited resources. Educators, for example, did not understand how to use the various web-based learning applications that were used concurrently in schools for learning exercises. This is in addition to the challenges of web organizing, as well as the fact that not everyone engaging in such studies has access to cell phones or note pads.

The spread of COVID-19 has positive and negative sides. Lestiyanawati (2020) study investigates the problems that faced teachers during online classes in the lockdown. The study has reported that some old teachers faced many problems in dealing with e-learning tools and technologies. Moreover, the survey has shown that many teachers and students do not provide facilities. Some students are provided with internet connection and others depend on themselves to provide internet. Furthermore, many teachers have reported that they feel frustrated from e-classes because they are not sure of student's understanding of material as in face-to-face classes. Some students do not have access to the internet and some schools do not provide them with internet. Teachers felt regret on some students who are economically poor because their families cannot buy them new smartphones or laptops. Moreover, parents control children in the home during online classes so they should support their children to attend e-classes. The survey has discovered that children who received more support from their parents attend classes more than others

Online classes are a system of interactive online classes. This new method of teaching is due to worldwide COVID-10 spread. (Özüdoğru (2021) study explores the problems of online classes. Student's understanding of reading material is also a problem. Some teachers are unable to use internet connection in online classes. Some students mark the attendance sheet at the beginning but they are no longer active until the end of the class. Despite the previous problems, some teachers

noticed that some students have everything they need for online classes but they do not attend their e-classes. Some parents also face problems with their children. Many of them work outside in the public and private sector so they cannot manage their children's attendance to classes

Based on this survey in Indonesia, many teachers have faced many obstacles in the new shift of online learning. Many teachers have not received enough training before sudden circumstances due to COVID-19. Students and parents have not prepared and supported for a new level of independent learning at home. Also, parents spend a high budget on improving the internet connection. Many teachers have taken a long time before starting their classes because they need time to prepare well. Many teachers have faced the problem of applying their skills in online classes because they have received training for normal and face-to-face classes. Furthermore, the absence of governmental guidelines for implementing distances learning. Azhari& Fajri, (2022) has focused on showing that despite sudden circumstances and challenges faced by teachers. Many teachers have investigated new ways of teaching to deliver information to students in a soft way such as demanding easy tasks, some teachers offer free access to information, some teachers use phone calls or text messages to ensure that students are continuing their tasks and some teachers have tended to explain lessons in TV programs, radio and podcast and students should summarize lessons.

Many teachers have reported after the survey that students are unable to learn teamwork, social and communication skills because teachers are not able to apply teamwork activities, peer working and role playing strategies during distance learning. As a result, many teachers have changed their way of teaching social and collaborative skills because they require real and physical relationships and interactions with students in order to teach them social skills. Moreover, some teachers have called attention to student's feelings and interactions with others during the pandemic. Many students are unable to express their feelings as used in face-to-face environments. Teachers have found that many students are under pressure, stressed, feeling anxiety, self-confidence, missing leadership skills and have problems in relational discipline. Alsubaie (2022) has pointed out that these feelings are because of the lack of technological experience from students, teachers and parents before COVID-19. Furthermore, this study has explored the inequality in reaching digital devices among students. Many students do not have access to technological, digital devices and academic material via the internet

The difficulties in the Secondary School e-Learning Process come from a lack of exact analysis of educational needs and matching of those needs to the features of the electronic system, which might result in an unpredictable educational process flow. This is further complicated by school personnel who are unfamiliar with e-learning. These facts spurred a search for new options and the creation of whole new e-learning platforms that better met the needs of the target audience. As a result, during the implementation and validation of the system, the planning concentrated on the pedagogical and didactical problems.

Palestine is trying to study the level of students and to investigate the reasons why many prevailing challenges exist for mathematics and science teachers: First, Palestinian students consistently underperformed in international assessments, especially the study of "Trends of the International Mathematics and Science Studies (TIMSS)". Second, Palestinian mathematics and science teachers' content and pedagogical knowledge need improvement (Yarrow, et al,2014). Third, the COVID-19 pandemic is an emergency situation in Palestine, as elsewhere. Fourth, the central government still plays a major role in administering most educational policies, such as curriculum and national exams

Study Problem and Aims

The current study aims to investigate e-learning barriers experienced by Palestinian high school mathematics and science teachers amid the COVID-19 pandemic. The study examines the relationship between each level of barriers and assesses differences in teachers' views on the barriers according to their perceptions. Findings from the present study will help to advance our understanding of e-learning integration barriers amid the COVID-19 pandemic in the context of developing countries at the high school level. This study will also enable those responsible for workforce development to focus on the most basic potential obstructions to fruitful e-learning.

Therefore, this study adds valuable insight to the e-learning literature and provides important suggestions to improve e-

learning practices. To achieve those aims, this study aspires to answer the following research questions:

1. What are the barriers to e-learning use that mathematics and science teachers view as significant during the COVID-19 pandemic?
2. Are there any significant differences in teachers' views on barriers to e-learning use according to the variables of specialization, teacher qualification?

Related Literature And Conceptual Framework

The Significant of E- learning

E-learning is the combination of content and teaching methods delivered through media elements such as text or graphics on a computer to build knowledge and skills relevant to individual learning objectives and organizational performance (Racat, & Lichy, 2022).

However, authors defined e- learning in our study as the utilization of PC network technology, principally finished or conducted through the web, to convey data and instruction to students.

As we all know technology has the ability to transform education, especially in emergency circumstances. Besides this, it provides digital literacy to the learner, which is essential to survive in the competitive world and easy to use while the student is away from school. It also broadens the horizons of many learners by connecting them to the entire world. Furthermore, it contributes to collaborative learning. It makes learning accessible easily. Research evidence indicates that proper implementation of e-learning in education improves the efficiency of educational processes and promotes group problem-solving activities and articulated projects. It facilitates their learning and makes learning an interesting and practical exercise connected to their modern life-styles. It can be used as an effective resource for implementing constructivist pedagogy among the learners (Singh,2016).

Several arguments are associated with e-learning. Accessibility, affordability, flexibility, learning, pedagogy, life-long learning, and policy are some of the benefits attributed to online pedagogy. It is said that the online mode of learning is easily accessible and can even reach rural and remote areas. It is considered to be a relatively cheaper mode of education in terms of the lower cost of transportation, accommodation, and the overall cost of institution-based learning. Flexibility is another interesting aspect of online learning; a learner can schedule or plan their time for completion of courses available online. Combining face-to-face lectures with technology gives rise to blended learning and flipped classrooms; this type of learning environment can increase the learning potential of the students because they can learn anytime and anywhere, developing new skills in the process, leading to life-long learning (Author, 2021).

E-learning Barriers

Barriers are a wide range of difficulties or challenges that researchers have identified. Lack of technical skills and incapacity to manage organizational change, namely the ability to use technology, lack of user assistance, trouble with availability of technology, and workload concerns, have all been identified as common impediments in e-learning (Becker et al.,2013). Schoepp (2005, p. 2) offers another definition of obstruction: "any condition that makes it difficult to make progress or achieve a goal." Schoepp's (2005) definition was used in this paper.

E-learning hurdles have been classified in a variety of ways. Muilenburg and Berge (2005) describe an exploratory factor examination study that revealed the basic components that underpin web-based learning using a large sample of students (n = 1,056). The eight elements discovered were (a) administrative issues, (b) social interaction, (c) academic skills, (d) technical skills, (e) learner motivation, (f) time and support for studies, (g) cost and access to the Internet, and (h) technical problems. Gender, age, ethnicity, type of learning institution, self-rating of online learning skills, effectiveness of learning online, online learning enjoyment, prejudicial treatment in traditional classes, and the number of online courses completed were all autonomous factors that fundamentally influenced appraisals of these determining factors. The number of courses discontinued was the only variable that did not indicate significant variations between the means, and this variable had far too few persons in most categories.

Andersson(2008) decided to distinguish which of these challenges were typically noticeable for an e-adapting course in

Sri Lanka, employing a broad system of e-learning empowering impacts and disablers (numbering 37 components). The data for the inquiry was acquired from 1,887 sources between 2004 and 2007. In the accompanying zones, the research identified seven key difficulties: Student assistance, flexibility, teaching and learning activities, accessibility, academic confidence in students, content localization, and attitudes to e-learning.

Assareh and Bidokht (2011) identified four sorts of barriers:

- The Learners; which includes money-related issues, motivation, evaluation, detachment from peers, skill and experience, social domain.
- The Teachers' e-learning barriers, such as lack of sufficient information about e-learning, problems with evaluation.
- The e-learning curriculum, which concerns quality, resources, teaching process and evaluation.
- School is the last e- learning barrier and comprises authoritative and structural components.
- They found that, beside all of this preparation, they should take care that the lack of interaction among learners and teachers should not lead to isolation of students and feelings of anxiety for not learning the curriculum.

Pappas(2016) investigated eight barriers affecting e-learning. He classified barriers into: Limited Tech Experience, past e-learning Experience, Lack of Motivation, Personal Cognitions, Too Challenging eLearning Materials, Inadequate Support, Lack of Community Involvement, Online Learner Boredom.

In this study, we classified e-learning barriers based on the classification of Assareh and Bidokht (2011) and Almanthari et al(2020); namely, teachers, schools, curriculum and students. The barriers in terms of teacher level included: Limited Tech Experience, Past e-learning Experience, Lack of Motivation (Pappas,2016). Teachers' attitudes to change their practice, teaching activities (Anderson,2008). Academic skills and technical skills for students (Muilenburg and Berge,2005).

As we see from the literature, the barriers of e-learning that face teachers are: students and teacher slack skills and knowledge in using e-learning, the lack of resources and internet, un suitable curriculum, so we need digital content, lack of motivation for students and teachers, no community involvement, problems in school policy and system and students' evaluation and lack of training. All these barriers should be addressed by the ministry of education to avoid them in future in the same circumstances.

Methodology

The current study followed the survey research, which is a quantitative approach; that deals with quantified and analysing variables in order to get results. It involves the utilization and analysis of numerical data using specific statistical techniques to answer questions. It also describes the methods of explaining an issue or phenomenon through gathering data in numerical form (Apuke,2017). This approach is considered capable of providing reliable, valid, objective and generalizable findings (Fraenkel et al., 2011).

The electronic questionnaire was distributed by the coordinator of the Research and Development Center in the Directorate of Ramallah and Al-Bireh, who worked to circulate the questionnaire link to schools and teachers.

The Study Population and sample

The population of the study consisted of all high school science and mathematics teachers in Directorate of Ramallah and Al- Bireh, containing classes from 5th grade to 9th grade, of which the total number in the 2019/2020 academic year was 326. Stratified random sampling was employed in this study. The sample consisted of (104) participants from Ramallah and Al Bireh Directorate. The tables below (Tables 1) show the distribution of the sample according to specialization, level of education,. By specialization, they were 52% science teachers and 48% mathematics. The majority of participants had a bachelor's degree (65%).

Table. 1. Demographic Background of participants

Demographic Background	No. of participants		Percentage%
Specialization	Science	54	52%
	Mathematics	50	48%
Qualification	Diploma	8	8%
	Bachelor	68	65%
	Master & PHD	**28**	**27%**

The Study Instrument

The instrument of the study was a cross-sectional questionnaire (Fraenkel et al., 2011). All barriers were coded on a 5-point Likert scale. In terms of reliability, we utilized composite reliability and variance extracted value.

The questionnaire was tested on a survey sample (Pilot) of 19 participants (8 males and 11 females) who were high school mathematics and science teachers selected randomly from the original population but not from the sample. To find the reliability, Cronbach's alpha was calculated, with a value of 0.91, which indicates that all items had high levels of reliability and measure the same concept.

And for the validity of the instrument, it was sent to 5 experts who are specialized in education, they evaluated the items then researchers modified according to their comments and suggestions.

Data Collection and Analysis

Data was collected by means of an online questionnaire. We decided to use an online questionnaire because teachers were working online during the pandemic. The questionnaires were distributed after schools had been closed and the participants had been requested to use e-learning methods.. The questionnaire was opened for a month to enable teachers to fill up the questionnaire.

160 questionnaires were distributed, of which 110 were returned and 104 were fully completed. Hence the statistics discussed in the following sections are based on 104 completed questionnaires.

Descriptive statistical analysis was conducted to answer the research questions. The mean and standard deviations of responses for all the barrier options were calculated and presented in tables. An independent t-test and ANOVA were employed to examine differences between barriers according to the participants' perceptions. The Scheffé test was also used to examine the differences between groups.

For scale correction, we use a five-point Likert scale, which is a method for measuring behaviors and is used in questionnaires, especially in the field of statistics. The scale is based on responses that indicate the degree of approval or opposition to the arithmetic mean. As shown in table 2, we used the correction key to help us to judge responses and the extent to which teachers felt they faced barriers in e- learning.

Table 2. Correction Key

The degree of impact	Degree
Less than 50%	**Very low**
Between 50%- 59.9%	**Low**
Between 60%-69.9%	**Medium**
Between 70%-79.9%	**High**
More than 80%	**Very high**

RESULTS:

This section presents descriptive results of the barriers facing science and mathematics teachers during the Pandemic and it is followed by a presentation of the results of repeated measure analysis.

Question 1: What are the barriers that mathematics and science teachers view as significant to e-learning use during the COVID-19 pandemic?

As mentioned earlier, barriers were divided into four categories; teacher, school, curriculum and student barriers. The results are presented in Table 3.

Table 3. Summary of barriers at each level

Construct	Mean	St Dev	Percentage	Level
Teacher-level barriers	3.47	0.59	69%	Medium
School-level barriers	3.59	0.69	72%	High
Curriculum-level barriers	4	0.64	80%	Very high
Student-level barriers	4.36	0.72	87%	Very high
Total	3.78	0.47	76%	High

As shown in the table, the level of barriers that faced high school science and mathematics teachers were felt to be "high"with (76%) with a mean response of 3.78 on the 5-point correction scale. Regarding teacher-level barriers, the results showed a perceived "medium" level of barriers, with a mean response of 3.47. In terms of the school-level barriers, the results revealed a perception that they were "high", with a mean response of 3.59. Results of the curriculum and students level barriers showed that a very high perceived level, with mean responses of 4.0 and 4.36 respectively.

We describe the results of the e-learning barrier analysis in tables 4,5,6,7 which show the views of high school science and mathematics teachers on all the factors.

Barriers at teachers' level:

We note through the data in Table (4) that the barrier at the teacher level was medium, in terms of the percentage of the arithmetic mean and percentage response (69%). We also note that Item8, "There was stress from the frequent requirements of e- learning", obtained the highest percentage response of 84%, a very high level.

Table 4. Descriptive results of teacher-level barriers to e-learning during the COVID-19 Pandemic

No.	Levels Teacher Level barrier	Mean	St Dev	Percentage	Level
1	During the Covid-19 pandemic, I lack the necessary expertise and skills to use e-learning effectively.	3.25	0.98	65%	Medium
2	During the Covid-19 pandemic, I am not confident in using e-learning.	2.90	0.93	58%	Low
3	I've worked in e-learning before.	3.87	0.94	77%	High
4	During this pandemic, I assume that using e-learning in the classroom is ineffective.	3.60	0.83	72%	High
5	It is inconvenient for me to use E-learning during this pandemic.	3.61	1.05	72%	High
6	I don't have the skills to create educational e-learning materials.	3.13	0.99	63%	Medium
7	I am unable to use e-learning-appropriate learning techniques.	3.12	0.90	62%	medium
8	There was stress from the frequent requirements of e-learning.	4.20	0.83	84%	Very High
9	I don't have enough experience with evaluation instruments. In e- learning	3.55	1.02	71%	High
	Total	**3.47**	**0.59**	**69%**	**Medium**

As for item 2, "During the Covid-19 pandemic, I am not confident in using e-learning.", it is the lowest-scoring item, at 58%.

Barriers at school-level:

Table 5. Descriptive results of school-level barriers to e-learning during the COVID-19 Pandemic

No.	Levels School-Level barrier	Mean	St Dev	Percentage	Level
1	There is no e-learning system at my school.	3.78	0.92	76%	High
2	My school does not have access to the internet.	3.60	1.01	72%	High
3	During the Covid-19 pandemic, school rules prohibit the use of e-learning.	3.06	0.91	61%	Medium
4	Textbooks are incompatible with the use of e-learning.	3.62	0.93	72%	High
5	My school does not provide technical support for e-learning use	3.59	1.23	72%	High
6	My school does not provide the educational and psychological support I need during the Covid-19 pandemic	3.46	1.13	69%	Medium
7	There is no transparent electronic education framework in place at the school.	3.77	0.99	75%	High
8	My school did not provide me with the financial tools I needed to introduce e-learning (computers, headphones, and tablets....)	3.82	1.04	76%	High
	Total	**3.59**	**0.69**	**72%**	**High**

We note through the data contained in Table (5) that the barriers at school level were perceived to be high, in terms of the percentage mean (72%). We also note that item1, "There is no e-learning system at my school," obtained the highest percentage mean of 76%, a high level of agreement.

As for item3, "During the Covid-19 pandemic, school rules prohibit the use of e-learning.", it is the lowest percentage score (61%), with a medium level of agreement.

Barriers at curriculum level:

Table 6. Descriptive results of curriculum-level barriers to e-learning during the COVID-19 Pandemic

No.	Levels Curriculum-Level barrier	Mean	St Dev	Percentage	Level
1	The programme does not complement the learning and instructional tools accessible on the e-learning framework.	3.49	0.85	70%	High
2	Assessments that are not in accordance with the use of e-learning are expected by schools.	4.18	0.87	84%	Very High
3	My subject's content is challenging to teach using e-learning.	4.05	0.83	81%	Very High
4	The contents of my scientific subject, as well as other mathematics and science topics, cannot be taught using e-learning.	4.19	0.79	84%	Very High
5	In vocational and technical education, e-learning is difficult to implement.	4.09	0.88	82%	Very High
6	E-learning makes it difficult to carry out realistic exercises in science and mathematics.	4.02	0.87	80%	Very High
	Total	**4.00**	**0.64**	**80%**	Very High

We note through the data contained in Table 6 that barriers to e-learning during the pandemic at the curriculum level were perceived a survey high, with a percentage mean of 80%. We also note that item 4, "The contents of my scientific

subject, as well as other mathematics and science topics, cannot be taught using e-learning.", obtained the highest percentage mean of 84%, at the level of Very high. Item 1, "The programme does not complement the learning and instructional tools accessible on the e-learning framework," is the lowest-scoring item in this section, with a score of 70%, which is still a high level.

Barriers at student level:

Table 7. Descriptive results of student-level barriers to e-learning through COVID-19 Pandemic

No.	Levels Students Level barrier	Mean	St Dev	Percentage	Level
1	My students lack adequate knowledge about how to use e-learning.	4.37	0.93	87.4%	Very High
2	My students lack the requisite skills to use e-learning effectively.	4.30	0.82	86.0%	Very High
3	My students do not have access to e-learning equipment (such as a laptop or tablet).	4.39	0.79	87.8%	Very High
4	My students are not interested in using e-learning	4.39	0.73	87.8%	Very High
5	My students do not have access to the internet to use COVID-19 Pandemic..	4.34	0.87	86.8%	Very High
	Total	**4.36**	**0.72**	**87.2%**	Very High

We note through the data contained in Table 7 that the barriers of e- learning during the pandemic were perceived as very high, in terms of the percentage mean at 87.2%. We also note Items3 and 4 which say, "My students do not have access to e-learning equipment (such as a laptop or tablet)." and "My students are not interested in using e-learning", obtained the highest percentage, with the arithmetic mean of 87.8%, a very high level. Item2," My students lack the requisite skills to use e-learning effectively", has the lowest percentage of agreement (86%), which is still a very high level.

Question 2: Are there any significant differences in teachers' views on barriers to e-learning use according to demographic variables (specialization, teacher qualification)?

In order to answer this question, it was necessary to examine the following hypotheses:

First hypothesis: "There are no statistically significant differences at the level of p≤ 0.05 between the response of teachers from different specializations in relation to the application of e-learning during the COVID-19 pandemic from the viewpoint of high school science and mathematics teachers."

To answer this hypothesis, we used the t-test for two independent groups (Independent Sample t-test), and the results were as shown in Table 8.

Table 8. Results of Independent t-test for the barriers that face science and mathematics high teachers according to Specialization

Levels	Science		Mathematics		t- value	Probability
	Mean	St Dev	Mean	St Dev		
Teacher-Level barrier	3.53	0.46	3.53	0.46	1.12	0.27
School-Level Barrier	3.55	0.74	3.55	0.74	-0.62	0.54
Curriculum-Level Barrier	3.89	0.69	3.89	0.69	-1.87	0.07
Student-Level Barrier	4.38	0.69	4.38	0.69	0.35	0.73
Total	**3.76**	**0.47**	**3.76**	**0.47**	**-0.25**	**0.80**

Through the data in Table (8) we accept the null hypothesis, meaning that there are no statistically significant

differences between the responses of teachers from different specializations in relation to the barriers facing teachers in implementing e-learning during the pandemic from the viewpoint of high school science and mathematics. The level of significance ranged between 0.07 and 0.80, and these the values are all outside the significance level (p<=0.05).

Second hypothesis: "There are no statistically significant differences at the level of p≤ 0.05 between the response of teachers facing the application of e-learning during the COVID-19 pandemic from the viewpoint of high school science and mathematics teachers according to their academic qualifications".

To answer this hypothesis, we used standard deviations, and the one-way ANOVA test for more than two independent groups, and the results were as shown in tables 9 and 10.

Table 9. Averages for the barriers that face high school science and mathematics teachers according to their qualifications

Levels	**Diploma**	**Bachelor**	**Master & PHD**
Teacher-Level Barrier	3.81	3.48	3.34
School-Level Barrier	3.38	3.53	3.79
Curriculum-Level Barrier	3.75	4.00	4.08
Student-Level Barrier	4.10	4.33	4.49
Total	3.72	3.76	3.83

Table 10. Results of ANOVA for testing the significance of teachers' qualifications

Levels		**Sum of squares**	**Degrees of freedom**	**Average of squares**	**F**	**Probability ***
Teacher-Level barrier	Between groups	1.41	2	0.70	2.10	0.13
	Within groups	33.85	101	0.34		
	Total	35.26	103			
School-Level Barrier	Between groups	1.69	2	0.85	1.81	0.17
	Within groups	47.06	101	0.47		
	Total	48.75	103			
Curriculum-Level Barrier	Between groups	0.69	2	0.35	0.85	0.43
	Within groups	41.36	101	0.41		
	Total	42.05	103			
Student-Level Barrier	Between groups	1.09	2	0.54	1.05	0.35
	Within groups	52.09	101	0.52		
	Total	53.17	103			
Total	Between groups	0.13	2	0.06	0.29	0.75
	Within groups	22.52	101	0.22		
	Total	22.65	103			

Through the data in Table 10, we accept the null hypothesis for all levels; meaning that there are no statistically significant differences between the responses of teachers with different qualifications in relation to the barriers facing teachers in e-learning in light of the Corona pandemic. The level of probability ranged between 0.13 and 0.75, and these values are outside the level of significance (p<=0.05).

Discussion

This study examined high school science and mathematics teachers' views on barriers facing them in e-learning during the COVID-19 pandemic in Palestine, and the differences in teachers' views according to various parameters.

First, the level of barriers perceived by high school science and mathematics teachers is high, and the highest barriers were on the students' level, then on the curriculum level. We attribute this to many reasons; students are not interested in using e-learning and they don't have the required skills in using their devices to use them in e-learning, or they don't have devices or an internet connection to use in e- learning. Added to these, students do not have the motivation to study by e-learning, which needs time and requires more effort, as reported in the studies of Assaeh and Bidokht(2011), Almanthari et al.(2020),Muilenburg and Berge (2005), Lestiyanawati (2020). Also, in Palestine there are important differences in status because of the occupation, as reported by Papapas(2016).

The barriers on the curriculum level were perceived as very high, possibly because the contents of scientific books, such as those used in mathematics and science, cannot be taught using e-learning; teachers need training to design digital content, and the resources in their schools are not suitable to implement activities and experiments, as they need more animation, which is not found in their content books. These results are similar to Anderson (2008), Özüdoğru (2021), Alsubaie(2022) Furthermore, content in books does not support evaluation of students in different ways that suit e-learning, as reported in the study by Assaeh and Bidokht(2011).

Second, the study found no statistically significant differences according to specialization or academic qualifications overall, or on the levels of students and curriculum, which means that neither specialization or academic qualifications have affect on the teachers' knowledge about good planning, preparation, achieving educational goals or taking into account individual differences, learning styles and students' needs in E-learning, or developing new skills in the e- learning process (Author, 2021).

Concluding Remarks

The results indicate that the barriers facing high school science and mathematics teachers in implementing e-learning as a tool of instruction during the COVID-19 pandemic are high, and the highest barriers are those on the student level, then on the curriculum level. This means teachers need more training in using technology to have the ability to design suitable digital content for their students, flipped classes where teachers can employ content more effectively and develop their students' skills for long life learning, and they need a training to apply teamwork activities, social and communication skills.

The results also show that students must gain more e- learning skills and knowledge from their teachers especially more sites of animation, content creation and educational assignments. Also, the parents must help teachers in pursuing e-learning and encourage their children to attend e- learning classes and be active.

The Ministry of Education and Telecom Company must find a way to reduce the cost of internet services and devices to prepare students for e-learning. At the level of schools, new policies must be established to support e-learning in terms of e-learning strategies and evaluation and blended learning. In addition, the ministry must create virtual classes as support for e-learning, spreading the e-learning culture, and providing experts to maintain continuous communication with teachers to solve technical problems.

Finally, the study recommends doing another study to investigate e-learning obstacles from the point of view of parents and students, and studying the impact of educational platforms and portals on learning and teaching. We also recommend doing studies aimed at the teachers' training needs for e-learning.

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