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Mathematics Distance Learning amid the COVID-19 Pandemic in the UAE: High School Students' Perspectives

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Abstract. In light of the COVID-19 pandemic that has resulted in several countries being locked down, there has been a paradigm shift in terms of learning worldwide. As a result, educational institutions in the United Arab Emirates (UAE) have acted swiftly and shifted from face-to-face education to distance learning. Thus, this study investigated high school students' perspectives on the distance learning of mathematics. The research employed a quantitative method using a developed and validated online survey. The convenience sampling consisted of 580 high school students in Al Ain. Descriptive statistical analysis of the mean and standard deviation of scores was used and then interpreted based on Gagné's rating (1991). In general, the results showed that the students had an ambivalent view of their distance learning experience. Notably, students' most negative perceptions were about missing the interaction with teachers and colleagues, and disapproving of the unfavourably long screen times. Furthermore, 78.3% of the participants showed no preference for choosing to study mathematics by distance learning in the future, given a choice. This study has extra relevance since the process of distance learning has become more prevalent in the UAE owing to the COVID-19 pandemic. Thus, it is imperative that educational institutions try to understand the complexity and embedded nature of distance learning, and the challenges encountered by students while they are studying mathematics in an online environment.

Keywords: COVID-19; distance learning; mathematics; online learning; United Arab Emirates

1. Introduction

COVID-19 was declared a global emergency by the World Health Organization (WHO) on January 30, 2020, and then a global pandemic on March 11, 2020

(WHO, 2020). This disease is highly contagious (Liu et al., 2020). The global spread of COVID-19 has led to profound changes in social interaction and organization, and the education sector has been no different. Many countries have implemented strict social distancing measures in attempts to inhibit the virus from spreading in dense social networks such as schools and universities (Weeden & Cornwall, 2020). Consequently, on March 12, 2020, 46 countries had declared school closures and 26 of these countries had fully closed schools nationwide (Huang, Liu, Tlili, Yang & Wang, 2020).

The concept of distance learning is not new, as it started in the 1990s and has gained increasing legitimacy, as revealed by major international agencies such as UNESCO and the World Bank, and many national policies (Perraton, 2000). As well as this enforced change, the education sector as a whole has been undergoing a more general paradigm shift with the advent of technology (Perienen, 2020). Although, as O'Brien (2020) states, "*The adoption of distance learning comes as organizers and associations around the world adapt to rules prohibiting large gatherings*", Noonoo (2020) notes that some schools lack controls to deal with the pandemic, while others are better prepared and recognize the need for alternative means of providing education. Schools must adopt distance learning via the Internet, especially when there is an urgent need to provide education to students regardless of their location. Education is an ongoing process, and therefore it should enjoy the utmost priority because it is the key to global development (Brende, 2015).

However, although online learning or e-learning has been a major trend in higher education (Almuraqab, 2020; Osman, 2018; Quadri, Muhammed, Sanober, Qureshi & Shah, 2017; Yen & Lee, 2011), it is fairly new in K-12 schools. Despite this, in a meta-analysis study (Hillmayr et al., 2020), evidence was found of the use of digital tools to enhance mathematics and science learning in high schools. However, most studies were conducted in normal situations where distance learning is optional to improve the teaching and learning process.

Mathematics is usually viewed as challenging even under normal circumstances (Fritz, Haase & Rasanen, 2019). A few studies on distance learning were conducted previously during pandemics (Ash & Davis, 2009). In fact, mathematics was not the focus of many of these studies (Astri, 2017). Many studies focused on using technological tools as a mediator in teaching mathematics; however, in this situation of the pandemic teachers are alone with these technologies and the students are far away. For example, Juliane, Arman, Sastramihardja and Supriana (2017) studied digital teaching and learning for digital natives while Quadri et al. (2017) investigated the barriers affecting the e-learning implementation in Saudi Arabian universities. Thus, it is important to understand how students perceive the experience of distance learning in mathematics such as using platforms and Microsoft Teams and other applications as it has a special nature, unlike other subjects. Although the technology used as platforms was useful for teachers and students in sharing ideas and discussions in distance learning, these were considered inadequate for teaching mathematics as efficiently as traditional face-to-face teaching (Fedele &

Li, 2008). For example, teaching many subjects requires discussions, presentations, and elaboration on the learning outcomes from the students and their teacher while this is not the case for teaching mathematics where, in addition to the discussion, the teacher needs to communicate with students by writing words and symbolic language on the blackboard. This is not easy in distance learning (Cassibba et al., 2020).

At the time of writing, researchers have been concentrating on the knowledge required to adopt distance learning during the COVID-19 crisis. For example, Perienen (2020) focused on teachers as he investigated the factors which contribute to technology usage by mathematics teachers, and found that only a minority used technology in their practice. In the UAE context, Almuraqab (2020) focused on general university students' attitudes and found that a sample of UAE's university students wish to continue distance learning after COVID-19. Almuraqab's (2020) study will have implications for the decision-makers in the UAE higher education sphere. At the time of writing, no research has been found relating to school students in the UAE. This highlights the importance of investigating mathematics distance learning experiences for students during pandemics.

Because of COVID-19, the current situation is very new to all countries globally. Hence, the results of the current study will help advance our understanding of the integration of e-learning amid the COVID-19 pandemic in the context of developing countries at the high school level. Also, this study adds more insight into distance learning in the near future for better and more efficient education from the students' point of view. Hence, to add to the literature, this study considers the perspective of high school students in the UAE. Its purpose was twofold: (i) to illustrate high school students' perspectives about their mathematics distance learning experience during the COVID-19 pandemic; and (ii) to investigate students' preference to either continue distance learning or return to traditional face-to-face classes. The findings will help decision-makers understand what students think about their experience, and consequently improve distance learning in the UAE for all school subjects, especially mathematics. In this paper, the terms 'online', 'e-learning', and 'distance education' are used interchangeably.

This study sought to answer the following questions:
RQ1. What are the perceptions of high school students toward their experience of mathematics distance learning?
RQ2. Would high school students in the UAE prefer to continue mathematics distance learning after COVID-19?

2. Literature Review

Phipps and Merisotis (1999) stated that *"It is important to understand what is meant by 'distance learning.' Because the technology is evolving, the definition of what distance learning is continues to change"* (p. 11). Since it is necessary to define the concept, the literature review starts by defining the term and then studying its

opportunities and challenges. It then describes the UAE's transition to distance learning and discusses the students' perspectives.

2.1 Distance Learning Definition and Types

Merriam-Webster defines distance learning (n.d., para. 1) as "*a method of study where teachers and students do not meet in a classroom but use the Internet, e-mail, mail, etc., to have classes.*" Other definitions include that of the United States Distance Learning Association (Roblyer & Edwards, 2000) as "*the acquisition of knowledge and skills through mediated information and instruction, encompassing all technologies and other forms of learning at a distance*" (p. 192). King, Young, Richmond and Schrader (2001) provided a more precise definition of distance learning by first defining learning itself as "*improved capabilities in knowledge and/or behaviours as a result of mediated experiences that are constrained by time and/or distance such that the learner does not share the same situation with what is being learned*"(King et al., 2001). In accord with this definition, Midgely (2018) also defines distance learning in terms of remoteness between the student and teacher, that is, an absence of face-to-face contact in a classroom.

In addition to how these definitions refer to the distance of place, distance education can also be synchronous or asynchronous according to differences in time and the type of interaction (King et al., 2001). The former situations allow 'real-time' interaction and are time-sensitive, but geography is not a factor, while asynchronous situations are neither chronologically nor geographically sensitive. Many methods of distance learning are possible (Rodrigues, Almeida, Figueiredo, & Lopes, 2019). Hybrid learning (or blended learning) is different from synchronous and asynchronous learning as it combines traditional education with online tasks in an attempt to integrate the advantages of face-to-face teaching with web-based benefits (Ellis & Han, 2018; Ko & Rosen, 2008). This type of distance learning is not the focus of this research as face-to-face learning is impossible during the COVID-19 pandemic.

Tracking the history of distance learning, there is broad agreement among researchers that there are three major interlaced generations that can be identified for distance learning (Anderson & Dron, 2012; Bates, 2005; Gunawardena & McIsaac, 2004). The earliest stage of distance learning included postal correspondence, and the next used media such as radio, film, and television; the third and current generation facilitates education through interactive digital technologies such as networks that involve multiple students interacting with a teacher or each other via text, audio, and video. Current distance learning sessions are aligned with the third generation, and this may explain the interchangeable use in recent articles of the terms 'e-learning', 'online learning', and 'distance learning' in which live meetings and webinars facilitate learning.

2.2 Distance Learning Opportunities

The OECD (2019) emphasized the importance of mathematics and science literacy for social participation and stressed that they are "*necessary for finding solutions to complex (real-world) problems*" (p.6). However, the Program for International Student Assessment (PISA) has shown that many students globally

have difficulty learning mathematics (OECD, 2019). The use of digital tools has high potential for teaching and learning mathematics (Gunbas, 2015). Learning with digital tools can be beneficial in face-to-face as well as in distance learning, according to the cognitive theory of multimedia learning, as students need to participate actively in their own learning process to understand new information (Mayer, 2014). In this respect, interactive learning tools have a good effect on students' learning; however, this effect depends on the type of interactive digital tool used (Hillmayr et al., 2020). However, despite the fact that the use of the Internet facilitates the use of digital tools in teacher education methods, the focus of this study is on the benefits of distance learning in mathematics regardless of the use of digital tools, whether teachers are limited to using educational platforms or using interactive programs such as Geogebra or any other digital tool.

Nash (2015) states that online learning has experienced rapid growth and will continue to expand. The distinction between distance or online learning and face-to-face learning is that students of all ages can receive an education, even without going to class. Given this advantage, there is a surprising lack of research about distance learning in the field of mathematics. Of the existing studies, however, two have recently indicated that students learn mathematics better when effective and appropriate technology is adopted (Perienen, 2020; Niess, 2006). Educational technology experts have emphasized the positive benefits of online learning, especially when the physical site is a barrier (Ostankowicz-Bazan, 2016). In fact, distance learning today facilitates the educational process. For example, "*The synchronous environment demonstrates the amazing power of a synchronous online system that empowers students in conversation and expression*" (McBrien, Jones & Cheng, 2009, p. 13). Thus, distance learning is a unique solution to the continuation of learning in critical times, as in the recent case of the global pandemic of coronavirus.

There is a consensus in the literature that the main advantage of distance learning is that it allows participants to fit their learning around their work and home life (Anderson & Dron, 2012; Midgely, 2018). The flexibility of distance study is one of the main reasons for studying along this path (Anderson & Dron, 2012). Furthermore, Anderson and Dron (2012) explained that owing to the advancement of technology, such as using webinars, that now facilitates interactive distance learning, many distance learners can live and work in different countries and time zones from their teachers and peers. Distance learning also allows students to work at their own speed to achieve set goals, usually at a lower cost than with full-time education (Midgely, 2018). Moreover, distance learning enhances students' time management and research skills.

2.3 Distance Learning Challenges

Two decades ago, Phipps and Merisotis (1999) stated that technology is simply unable to replace the human factor in the educational process. This is still somewhat true, since the main distance learning challenge reported in the literature is social isolation and the lack of face-to-face contact with peers and teachers (Amin & Li, 2010; Bates, 2005; Ratnawati, 2018; White, 2003). White (2003) also links the decline of motivation to factors such as loneliness and

isolation, the absence of live interaction, competing obligations, and the difficulty of adapting to a distance learning method. However, recent improvements in technology may have lessened students' sense of isolation, while a growing set of activities, tools, and techniques has since been created to reduce feelings of isolation among learners (Bates, 2005). For example, White (2003) suggests that using synchronous sessions is highly motivating since it can reduce the feeling of loneliness and isolation among students.

Regarding student engagement in learning, Amin and Li (2010) investigated graduate students' distance learning experiences and found that providing such students with an interactive learning experience and connection to their online class requires more than limiting their interaction to posting notes and engaging in discussion; rather, teachers should involve their students in group work to keep them engaged. However, teamwork assignments can only be applied to specific lessons depending on the purpose of the lesson (Ratnawati, 2018). Moreover, other problems can affect student engagement in learning, such as lack of discipline and the difficulty of obtaining immediate feedback, which are both typical issues with online learning (Ratnawati, 2018). Distance learning requires self-discipline to complete the required tasks by giving priority and time to study. Another important challenge for online learning also mentioned by Ratnawati (2018) is the problem of Internet connection. This may be the most significant problem because it prevents students from joining live sessions or causes a delay between speech and reception. However, there are challenges of distance learning to teaching mathematics due to its unique nature. For example, Mayes et al. (2011) indicated that the anxiety any student feels about mathematics increases when combined with student isolation and class anxiety during distance learning in addition to the difficulty in communicating mathematical ideas, especially in the form of symbols or graphs.

2.4 Transition to Online Distance Learning in the UAE

The UAE has stopped traditional face-to-face schooling in favour of distance education owing to the pandemic (United Arab Emirates' Government portal, n.d.). Schools were suspended on March 8, 2020, bringing the spring break forward by two weeks; afterwards, students began learning from home for two weeks. Subsequently, the Ministry of Education decided to continue distance education until the end of the 2019–2020 academic year without losing a single teaching day (UAE Ministry of Education, 2020).

Even before the pandemic, the availability and utilization of e-learning infrastructure and platforms accelerated the migration of distance learning throughout the UAE. Schools and universities there have been at the forefront of developing digital learning by actively using e-learning applications. Mohammed bin Rashid's Smart Learning Program, for example, was utilizing e-learning applications and different supporting programs designed to help students gain an additional advantage in their learning long before the outbreak of COVID-19 (United Arab Emirates' Government portal, n.d.). Although, technology was used before the pandemic as a good way to teach mathematics among teachers and learners, after the pandemic teachers no longer had a choice

in becoming more dependent on technology even without much training in its use.

Ensuring a radical transition to online distance learning may seem difficult and almost impossible; however, schools that already use distance education have found that the transition has become easy (Noonoo, 2020). Thus, the Ministry of Education in the UAE has taken several steps to ensure the successful implementation of the distance learning process for schools and students by allowing private schools to use their own distance learning system and designating follow-up committees and teams to ensure that the learning process continues as well as in public schools. There is coordination with the Telecommunications Regulatory Authority (TRA), Du and Etisalat to provide free mobile Internet packages for families who need a home Internet connection (United Arab Emirates' Government portal, n.d.). Moreover, the Abu Dhabi Department of Education and Knowledge coordinated with private school departments and relevant partners to provide students with the tools and all other requirements necessary to activate the distance education programme forthe continuity of classes for students (Sebugwaawo, 2020).

The UAE provided licences or access to technology such as Microsoft Teams to all teachers and students. Training and guides were also given based on the main tools available. The UAE employs both synchronous learning tools via Teams for meetings chats, posts, and file sharing, and asynchronous learning tools using a learning management system (LMS) for assignments, tasks, homework and examinations. These key tools provide some consistency so that students are not overwhelmed by or rushed to learn different tools. Many teachers began to use live conferences (as synchronous learning) for the first time, but were nevertheless willing to take risks by using surveys and competitions to try to engage learners. In addition, the LMS allows teachers to manage student learning as they can upload resources and tasks (as asynchronous learning) and track student performance.

3. Methodology

The purpose of this study was to investigate the students' perceptions regarding their experience of mathematics distance learning. For this purpose, the research employed a descriptive survey design from the quantitative research approach to measure these perceptions. According to Fraenkel, Wallen and Hyun (2011), quantitative methods are considered capable of providing reliable, valid, objective, and generalizable findings. Choosing a descriptive approach is appropriate in research during the COVID-19 pandemic because it is easier to collect and explore the data fully as surveys are one of the most frequently used quantitative tools and can be conducted with a large number of participants. The data were collected on a voluntary basis via an online survey from students attending both public and private schools in the city of Al Ain in the Emirate of Abu Dhabi. The use of the online survey made it easy and convenient for participants to take part in the survey in their spare time.

3.1 Participants

The convenience sampling consisted of 580 high school students from grades 9–12 from Al Ain in the UAE. As Table 1 illustrates, the sample consisted of 101 students from grade 9 (17.4%), 183 students from grade 10 (31.6%), 154 students from grade 11 (26.6%), and 142 students from grade 12 (24.5%). The participants were distributed almost equally between public and private schools, with the number of the former being 291, and 289 from the latter. Regarding the male/female composition, the percentage of females was 68.3% (n=398), while that of males was 31.7% (n=184) (Table 1).

Table 1: Participant demographics

Participants		Frequency	Percent
Grade Level	Grade 9	101	17.4
	Grade 10	183	31.6
	Grade 11	154	26.6
	Grade 12	142	24.5
	Total	580	100
Type of schooling	Public	291	50.1
	Private	289	49.9
	Total	580	100
Gender	Male	184	31.7
	Female	396	68.3
	Total	580	100

3.2 Study Instrument

The survey was developed based on a review of the relevant questionnaire literature and especially on the researchers' experience as they were themselves involved in teaching mathematics during the first few months of the pandemic (June 2020). The development of the survey went through several stages before being finalized and distributed online. First, the researchers formulated a set of purpose-built questions and research questions based on their field observations of students' experience in mathematics distance learning using what students reported during their mathematics classes as well as their fellow mathematics teachers. After several revisions, the researchers approved the final draft for piloting. It was then validated by two faculty members specializing in mathematics education, and six mathematics teachers and supervisors, who checked the relevancy of the items of the survey. The feedback was used to modify the wording of some statements. In addition, before administering the survey, eleven students also checked that every item was clear. To establish the reliability of the survey, a pilot test was conducted with 50 students who were not participants in the main study. Cronbach's alpha, the most common measure of scale reliability, was used to calculate reliability and was found to be 0.90, indicating very strong reliability (Gay, Mills & Airasian, 2012).

The final draft of the survey consisted of three sections: the demographic questions (school type, gender, and current class); 24 close-ended questions with five-point Likert scales to describe the students' mathematics distance learning experience (scales ranged from 'strongly agree' [SA], 'agree' [A], 'neutral' [N], 'disagree' [D] to 'strongly disagree' [SD]); and three dichotomous items with Yes/No answers to evaluate the students' mathematics distance learning experience.

3.3 Data Collection

The survey was created and distributed online, sent to all high school students in government and private schools in Al Ain, and made available for one week. The submission of the survey included the goal of the study, which the participants had to read before participating. No payments or benefits were made or given to participants. In order to maintain anonymity, neither the name of the student or the school was required. The researchers emphasized that the answers would be used for educational purposes only and assured the participants that they could agree or disagree with the items of the study. In addition, the students' participation in this study was optional.

3.4 Data Analysis

After collecting the data, all the responses were coded. Descriptive statistical analysis of mean and standard deviation of scores were employed rather than overall scores and then interpreted based on Gagné's rating (1991). The mean scores were categorized by Gagné (1991) as follows: a mean score of 4–5 points was classified as high positive (HP), between 3.24–3.99 as positive (P), 2.75–3.25 as ambivalent (A), and 2–2.74 as negative (N). Scores under 2 were considered high negative (HN). Frequencies and percentages were calculated of three items in the third part of the survey.

4. Results

Regarding the first research question about the students' perspectives of their mathematics distance learning, Table 2 shows the means and standard deviations of the results for individual statements in the survey. In addition, the mean results for per individual statement rating were estimated using Gagné's (1991) interpretation. Negatively worded items were reverse coded before calculating the means.

Table 2: Students' perceptions of their mathematics distance learning experience

#	Item	Mean	SD	Rating
1	It provides flexibility in choosing the time to perform and deliver tasks even at night time	3.52	1.30	P
2	I can choose what suits me from a variety of learning resources such as worksheets, educational videos, educational websites, and others	3.56	1.19	P
3	I can access worksheets and educational resources anytime and anywhere because of a copy of them on the LMS	3.73	1.19	P
4	It allows me to work on activities at a speed that suits me	3.17	1.38	A

5	I can't focus on learning mathematics because of the inconvenience caused by my family*	3.20	1.42	P
6	Being away from classmates forces me to do maths exercises myself without help	3.21	1.35	A
7	I am more organized and my confidence in learning mathematics has increased	2.73	1.46	N
8	I miss the interaction and cooperation with students and the teacher in mathematics*	1.93	1.23	HN
9	I feel stressed and nervous due to my inability to work with computers and educational programs*	2.76	1.41	A
10	I missed some important information due to connection problems or weakness on the Internet*	2.12	1.26	N
11	Studying for long hours in front of a computer makes me tired*	1.71	1.10	HN
12	I receive feedback on my maths tasks, such as exams and assignments, in a timely and detailed manner	3.29	1.26	P
13	I do not like to participate in the maths class because of the difficulty of writing maths symbols using a computer*	3.22	1.39	A
14	I focus on understanding, not memorizing, during my study for the maths exam more than regular exams	3.58	1.25	P
15	I don't study for the mathematics exam and get answers to questions easily from others*	4.09	1.18	HP
16	I am constantly nervous and feel anxious due to assignments of assignments and tasks at any time on the LMS*	2.08	1.24	N
17	Due to the multiple tasks, I do not have enough time to complete all the required tasks per day for mathematics*	2.35	1.35	N
18	I can attend my classes even if I am away from home or feeling ill	3.44	1.28	P
19	I insist on recording my attendance in maths classes but without any involvement*	3.26	1.31	A
20	I participate and exchange ideas with the teacher and peers during discussions on mathematics more than before	2.74	1.39	N
21	The teacher uses more diverse methods of teaching mathematics than before	3.12	1.32	A
22	The focus was on the basic skills of mathematics more than the practical applications*	2.81	1.15	A
23	I feel satisfied with the distance learning experience in general	2.85	1.44	A
24	I understood maths lessons with equal competence before distance learning	2.63	1.49	N
	Average scale	**2.94**	**0.71**	**A**

Generally, the perceptions of mathematics distance learning were ambivalent as indicated by the scale mean (M= 2.94). However, the results showed high negativity for two items in the survey, indicating that students were tired because of the long screen time spent in front of their digital devices (M= 1.71) and that they missed the interaction with their teachers and colleagues (M=

1.93). On the other hand, students were very positive regarding their rejection of the statement that they did not study for the mathematics examination and easily obtained answers to questions from others (M= 4.09). The students' perceptions were positive for seven other items, ambivalent for eight, and negative for six items.

Regarding the second question on whether the students preferred to choose distance learning to study mathematics, Table 3 reveals the numbers and percentages of students for each of the items that describe their evaluation.

Table 3: Students' evaluation of mathematics distance learning and their preference for the future

Items	Response	**Frequency**	**Percent**
Distance learning is more suitable for mathematics than other subjects	Yes	135	23.3
	No	445	76.7
	Total	**580**	**100.0**
I face a challenge in studying mathematics during distance learning more than direct learning in the classroom	Yes	404	69.7
	No	176	30.3
	Total	**580**	**100.0**
If I have a choice, I prefer distance learning to study mathematics more than direct learning in the classroom after the COVID-19 crisis	Yes	126	21.7
	No	454	78.3
	Total	**580**	**100.0**

As seen in Table 3, 76.7% of the students rejected distance learning for the future on the grounds that it is unsuitable for mathematics in comparison to other subjects. Furthermore, 69.7% reported that they faced more challenges with distance learning of mathematics than with direct learning. Finally, 78.3% would not choose mathematics distance learning if they had the choice.

5. Discussion and Conclusion

The UAE's Ministry of Education has taken careful steps to apply distance learning to help limit the spread of COVID-19 by employing both synchronous and asynchronous learning in schools. However, the experience was not without some challenges in general, and mathematics in particular, as reported by more than two-thirds (69.7%) of the students. Around 78% would not choose distance learning to study mathematics given the choice. This result is not unexpected and is in line with Fedele and Li's (2008) research, which found that despite online systems being useful platforms, they may not be as appropriate for mathematics courses as traditional face-to-face classes. Moreover, the students also agreed with the teachers in their opinion of the difficulty of participating in the case of distance learning due to the difficulty of writing words and symbolic language necessary for the mathematics class (Cassibba et al., 2020) as the

students displayed negative perspectives towards writing mathematics symbols using a computer (M= 3.22).

The students had ambivalent general perspectives (M= 2.94) regarding their mathematics distance learning experience. Moreover, their responses were also ambivalent (M= 2.85) about the statement, "I feel satisfied with the distance learning experience in general" but were negative (M= 2.63) towards "I understand maths lessons with equal competence before distance learning". This indicates that improvements should be made to the distance learning process and more specifically to mathematics learning.

The most negative perspective (M= 1.71) concerned spending long screen time. In addition, in relation to technical issues, the students reported a negative perspective (M= 2.12) regarding missing important information due to connection problems. This is in accordance with Ratnawati's research (2018). Moreover, regarding technology, the students' perspectives were ambivalent (M= 2.76) towards their inability to use computers and educational programs. Similarly, they felt that the difficulty of writing maths symbols using a computer (M= 3.22) affected their class participation. However, this perspective was very close to being positive.

The second most highly negative perspective (M= 1.92) was for the statement "I miss the interaction and cooperation with students and the teacher in mathematics", as reported by many researchers (Amin & Li, 2010; Bates, 2005; Ratnawati, 2018; White, 2003). Likewise, the students held negative perspectives (M= 2.73) regarding distance learning making them more organized. In addition, the students had an ambivalent perspective (M= 3.26) to attending class with no interaction and being forced to be independent and do mathematics exercises themselves as their fellow students are not available (M= 3.21).

In accordance with Ostankowicz-Bazan's (2016) research, the students responded positively to all the statements that represent the flexibility of distance learning such as, "It provides flexibility in choosing the time to perform and deliver tasks even at night time", and similar items (2–4, and 18). Likewise, another positive perspective was towards receiving feedback on mathematics assignments (M= 3.29), in contradiction to Ratnawati (2018), who reported difficulty in obtaining immediate feedback as a problem of online learning. However, the students' perspectives were ambivalent, but very close to positive, towards both the teachers' use of more diverse methods of teaching (M= 3.12) and the focus on basic skills in mathematics distance learning (M= 3.19). This guides mathematics teachers on how to improve their practices in the distance learning experience. However, students responded positively (M= 3.58) to focusing on understanding more than memorizing for tests. This was supported by the highest positive response (M= 4.09) to, "I don't study for the mathematics exam and get answers to questions easily from others", indicating their rejection of cheating.

To conclude, the students' view of the distance learning experience of mathematics was not decisive as the distance learning experience provided them with many advantages such as flexibility and independence in education. However, it confronted them with many challenges such as technical problems that deprived them of some of their lessons, and the long hours they spend in front of the screens of their devices in addition to missing the interaction with their colleagues and teachers.

6. Implications and Future Research

Despite the emergence of distance learning technology and its widely expected use in mathematics education, little research has been conducted on the interaction of teaching, learning, and distance education in mathematics. Therefore, more research is needed on how to teach mathematics effectively in an online environment, and what constitutes productive learning in such an environment.

The distance learning employed in UAE schools includes synchronous and asynchronous learning, which includes many positives and benefits. However, the most prominent result of this research was that students missed the interaction with their colleagues, in addition to spending a great deal of screen time on their digital devices. The findings of this study motivate new areas of research, especially since, up to this point, no effective treatment for COVID-19 has been found and precautionary measures will continue to some extent in the near future. Since the continuity of education is a top priority, we should take advantage of this period of distance learning to improve it for all subjects, and mathematics in particular. The results of this study are therefore important for decision makers in education.

For future research, collecting qualitative data will deepen the understanding of students' perceptions and explore the differences in their learning styles, as well as considering how the applied teaching methods can affect students' experience of distance learning (Mayes et al., 2011). Moreover, more options should be studied for distance learning. Rodrigues, Almeida, Figueiredo and Lopes (2019) have indicated that there are many solutions available for distance learning. One might study blended learning, a combination of online and in-class learning (Ellis & Han, 2018; Ko & Rosen, 2008), which seems to be an appropriate solution for ongoing studies under the current circumstances. This might be especially fruitful since Almuraqab's study (2020) revealed that most university students in the UAE prefer blended learning.

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