11-2021

TEACHERS' PERCEPTIONS OF TEACHING MATHEMATICS ONLINE IN ELEMENTARY SCHOOLS IN AL AIN.

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This thesis is submitted in partial fulfillment of the requirements for the degree of Master of Education (Curriculum and Instruction)

Under the Supervision of Dr. Adeeb Jarrah

November 2021

Declaration of Original Work

I, Kamar Fayez Kamar, the undersigned, a graduate student at the United Arab Emirates University (UAEU), and the author of this thesis entitled "*Teachers' Perceptions of Teaching Mathematics Online in Elementary Schools in Al Ain*", hereby, solemnly declare that this thesis is my own original research work that has been done and prepared by me under the supervision of Dr. Adeeb Jarrah, in the College of Education at UAEU. This work has not previously formed the basis for the award of any academic degree, diploma or a similar title at this or any other university. Any materials borrowed from other sources (whether published or unpublished) and relied upon or included in my thesis have been properly cited and acknowledged in accordance with appropriate academic conventions. I further declare that there is no potential conflict of interest with respect to the research, data collection, authorship, presentation and/or publication of this thesis.

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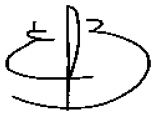
Signature  Date 28/2/2022

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Abstract

Online learning is an active method of learning in our lives, and it has been implemented in all the schools in the United Arab Emirates (UAE). Many methods such as platforms, online educational websites, and other applications were used by teachers to support online learning, and to be able to assist students to achieve their goals and accomplish what is required from their curriculum. The main objective of this study is to examine teachers' perceptions toward teaching mathematics using online learning in elementary schools. Data was collected from 90 (n= 90) elementary teachers in Al Ain City, UAE, during the spring semester of the 2021 academic year. A descriptive quantitative design was used to gather data using a 5-point Likert scale questionnaire. The results showed that the respondents were open to integrating digital technology in their teaching, while also being cautious regarding the increase of workload due to the integration. The barriers revealed by the results were the inability of the teachers to design a learning program that would get the most efficient results from the student in online learning settings. Moreover, the respondents agree that despite the support provided by the institutes in the integration of digital technology, they would still prefer face-to-face teaching in the future. The study contributes to the knowledge of educational systems and curriculum planners regarding the integration of digital technology in mathematics teaching in elementary schools. This study bridges the gap in mathematics teachings in a growing digital world.

Keywords: Online Learning, Mathematics, Elementary Schools, Online Teaching.

Title and Abstract (in Arabic)

تصورات المعلمين لتدريس الرياضيات عبر الإنترنت في المدارس الابتدائية في منطقة العين

الملخص

التعلم عبر الإنترنت أسلوب فعّال للتعليم في حياتنا، وقد تم تطبيقه في جميع مدارس الإمارات العربية المتحدة، كما تم استخدام العديد من الأساليب مثل المنصة، والمواقع التعليمية عبر الإنترنت، والتطبيقات الأخرى من قبل المعلمين وذلك لدعم التعلم عبر الإنترنت، والقدرة على مساعدة الطلاب على تحقيق أهدافهم، وإنجاز ما هو مطلوب من مناهجهم الدراسية، إذ أن الهدف الرئيس من هذه الدراسة هو دراسة تصورات المعلمين تجاه تدريس الرياضيات باستخدام التعلم عبر الإنترنت في المدارس الابتدائية، فقد تم جمع البيانات من 90 (ن= 90) معلم ابتدائي في مدينة العين، في دولة الإمارات العربية المتحدة خلال فصل الربيع من العام الدراسي 2021. كما تم استخدام تصميم كمي وصفي لجمع البيانات باستخدام إستبيان مقياس ليكرت المكون من 5 نقاط. وقد أظهرت النتائج أن المشاركين كانوا منفتحين على دمج التكنولوجيا الرقمية في تدريسهم مع توخي الحذر فيما يتعلق بزيادة عبء العمل بسبب الدمج، وكانت الحواجز التي كشفت عنها النتائج، عدم قدرة المعلمين على تصميم برنامج تعليمي من شأنه أن يحصل على النتائج الأكثر كفاءة من الطالب في إعدادات التعلم عبر الإنترنت، علاوة على ذلك، اتفق المشتركون على أنهم يفضلون التدريس وجهًا لوجه في المستقبل على الرغم من الدعم المقدم من المعاهد في دمج التكنولوجيا الرقمية. هذه الدراسة تساهم في مساعدة الأنظمة التعليمية ومخططي المناهج فيما يتعلق بدمج التكنولوجيا الرقمية في تدريس الرياضيات في المدارس الابتدائية كما وتربط الفجوة في تعليم الرياضيات في عالم رقمي متزايد.

مفاهيم البحث الرئيسية: التعلم عبر الإنترنت، الرياضيات، المدارس الابتدائية، التدريس عبر الإنترنت.

Acknowledgments

First and foremost, all praises and thanks are for Almighty Allah, the only creator of the universe and source of all knowledge and wisdom. I thank Him for all His blessings and strength that have been given to me to complete my master's degree.

I would like to express my deep and sincere appreciation to my thesis advisor Dr. Adeeb Jarrah for his continuous guidance, understanding, patience, support, and encouragement to accomplish this work. He taught me the methodology to carry out the research and to present the research in a perfect way. It was a great privilege and honor to study under his guidance.

I am extremely grateful to my parents, who have inspired me my whole life, and supported me all the way.

In addition, special thanks extended to my husband Ahmad and my daughter Maryam for their love, understanding, prayers**,** and continuous support to complete the research work.

Dedication

To my beloved father and daughter Maryam

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List of Abbreviations

E-Learning	Electronic Learning
ICT	Information and Communication Technology
IWBs	Interactive White Boards
MTSK	Mathematical Teacher's Specialized Knowledge
UAE	United Arab Emirates

Chapter 1: Introduction

1.1 Background

Information and Communication Technology (ICT) in integration in teaching practices by some teachers have been documented in the past decades. However, the current COVID-19 pandemic demands all teachers use communication mediums to teach their subjects online. Hence, integration and using technology is not an option anymore. Technology is developing every day. Developing technology is reflected in our society and lives, specifically in the educational sector (Hinojo-Lucena et al., 2018). The educational system is affected by ICT, and ICT is influencing the rapidity of the development of teaching and learning stages (Garrote et al., 2018). Using ICT can change the classroom and even the teaching process in schools and give students and teachers access to a greater amount of information in many different locations and many ways (Mat Salleh et al., 2019).

With those changes and enhancements that are controlled by ICT, there is Electronic Learning (E-Learning), which is known as receiving and taking place online using the internet and technological devices such as a mobile phone or even a laptop that can work from anywhere around the world (Cole et al., 2020). This method using E-Learning has become one of the most essential tools that enable access to teaching and learning for the whole world (Baby & Kannammal, 2020). E-Learning is becoming popular and used widely around the world due to the fact of the rise of COVID-19 (Mian & Khan, 2020). E-Learning provides the flexibility of time, place, and cost, and it provides the opportunity to teach students and evaluate them easily with the acknowledgment that teachers need to have an experience with digitals such as

platforms, educational videos, and techniques such as the use of computers, laptops, tablets, or even smartphones to use such a method (Zhu & Chen, 2019). Teachers and educators that are involved in E-Learning may face some challenges or some limitations as using or adjusting to E-Learning requires knowledge and a wide training of the use of digital competencies and teachers and even students need to be trained to use different ways of technologies and digital resources (Wan & Niu, 2020).

1.2 Statement of the Problem

The current COVID-19 pandemic has demanded online education to become a more realistic choice for students all over the world. As a result, an emerging challenge of determining the best ways to teach and teachers' views about teaching using this format and have become topics that need to be investigated. It was mentioned by Kennedy et al. (2013) and Thomas and Rieth (2011) that the use of multimedia and technology has been growing and has been used in many sectors such as the educational sector to be an effective method to deliver knowledge during the pandemic of COVID-19.

Since March of 2019 and as a response to deal with the spread of the COVID-19 virus, educational institutions in the United Arab Emirates (UAE) have shifted from traditional face-to-face education to online learning. Specifically, teachers had to switch and adapt to the new mode of instruction swiftly. Thus, this study will investigate Elementary Teachers' views on teaching mathematics online and this study will attempt to shed light on the challenges they face. Moreover, it is of great importance for educators in the UAE to understand and respond to teachers' insights to assist them to make online teaching better and enhance it to maximize students' gains from the new teaching format.

1.3 Purpose of the Study

Online learning can enhance teaching and support the educational sector as was mentioned by Jackson and Helms (2011), combining technology with education is attained to enhance results and the teaching process. Eyyam and Yaratan (2014) had a study for k-12 students for mathematics and they tested students into two groups; one was an online version of using the same test but with different methods of teaching, and the other one was traditional teaching with pencil and paper. Results came back to show that students that had the online test achieved better than the other group.

Using an E-Learning strategy can enhance learning if teachers were trained and sharing files and information and having online collaboration tools such as platforms can give support to students and even teachers to work better (Denton, 2012). Professional development was defined as "a comprehensive, sustained, and intensive approach to improving teachers' and principals' effectiveness in raising student achievement" (Hirsh, 2009).

The purpose of this study was to investigate teachers' perceptions of teaching mathematics online for elementary schools. Moreover, this research took an opportunity to declare and state if E-Learning and online teaching could be valuable for teachers and educators and more specifically mathematics teachers. In addition, the study investigated the challenges mathematics teacher faced while teaching mathematics online.

1.4 Research Questions

The study aimed to answer the following research questions:

- What are the perceptions of elementary teachers towards teaching mathematics online?

- What are the obstacles encountered by elementary teachers when teaching mathematics online?
- What are the elementary teachers' preferences for the future for teaching mathematics online?

1.5 Significance of the Study

The UAE always aims to be the leader in industrial and many sectors and especially in the educational sector, they seek to be one of the first countries to use technologies and online teaching in an effective way (Alnaqbi, 2020). Many teachers are not familiar with and don't know how to implement technology in their teaching method as this was one of the reasons for this research to be conducted that may add more information to the educational field about teachers' perceptions and views and how to use their views to make better online teaching specifically for mathematics teachers in the UAE.

Another significance of this research was the importance of online resources and teaching methods and how they affect students and teachers to perform better. The study aimed to find out the teachers' views regarding teaching mathematics online for elementary school, due to that it was a significant study as it focusses on the teachers' views and opinions regarding technology and digital resources and what they think about the E-Learning methods. In addition, the study exposed an understanding of teachers' perceptions on developing themselves and expanding their pedagogical, technological, and content knowledge along with their ways of traditional teachings methods.

The findings and results of this study would benefit the educational system and as well as the curriculum planners to tackle the problems of online teaching in

mathematics in elementary schools. This would enable school administrators and educators to plan the best methods of teaching and train their teachers with the required technologies and digital competencies to get them ready to use E-Learning as the new method of teaching.

1.6 Limitation of the Study

The framework of the study was limited to the teachers' self-perceptions on their methods of teaching and not to classroom observations to ensure if the perceptions match the observed classroom reactions. Moreover, this study cannot represent all teachers' perspectives in Al Ain due to the limited sample size.

1.7 Definitions of Terms

1. ICT: indicates the communication technologies such as the internet, networks, mobile phones, computers, software, video conferencing, online platforms, and other media applications.
2. Online Education: is a way or a method of education that is delivered through the usage of the internet. Online education can be grouped into different categories depending on the amount of online learning that is being used, having hybrid teaching or only online teaching.
3. E-Learning: it is a learning system that is obtained through the internet using electronic devices and can be called online learning or online education.

1.8 Summary

An overall background of the study was about using technology and online resources in life and specifically in the education sector. In addition, it has the purpose of the study is to find out the effects and perceptions of teaching mathematics online

over teachers. Moreover, this chapter shows the significance of the study and why it's essential to find out if online teaching has affected teachers or not. Moreover, it includes the research questions, research limitations, and assumptions of the study.

Chapter 2: Literature Review

2.1 Introduction

The purpose of this literature review is to provide points of view from different teachers around the UAE about online teaching. Thus, to maintain and accomplish the purpose of this study, the literature review contains the following divisions: the effects of technology over mathematics and education, the effects of technology in mathematics and teaching methods, and the perceptions of mathematics teachers towards online teaching for schools.

The literature regarding digital technology used in education has been collected by utilizing Google Scholar and Official documents. The keywords used for this research included “technology in education”, “digital technology in classrooms”, “mathematical education” and “use of technology in mathematical education”. This literature review aims to clarify some misconceptions regarding the use of digital technology in teaching mathematics as it is often assumed that only conventional methods of teaching can yield good results in this particular subject. However, the literature review would make a case for the integration of digital technology in this subject using prior studies that prove the efficiency of distance and online learning mathematics. The literature review would also provide insight into the importance of technology in learning and teaching mathematics.

2.2 Theoretical Framework

Before the pandemic of COVID-19, the digital technology used within the classrooms for mathematics was reported as inconsistent in terms of quantity, quality, and effectiveness (OECD, 2015a). Even though the use of digital technology for

education is viewed as imperative by some, however, there are still several questions with regards to when and how digital technology ought to be used and whether the use of it can transform and improve the experience of the students particularly in the education of mathematics (Bower, 2017). The crisis in education caused by the pandemic COVID-19 has forced teachers to rely on different digital technologies as a prime resource for learning and teaching regardless of the existing beliefs and practices related to the technology held by the teachers. However, this sudden and forced change may be viewed as an opportunity for considerable shifts in how technology is used by mathematic educators in future online, face-to-face, and/or blended classrooms (Attard & Holmes, 2020).

The use of technology can potentially oblige disruption in the education of mathematics that is vital considering the international concerns about the disengagement of students and the decline in enrolments in courses of senior mathematics (Thomson et al., 2017). For a range of reasons, the resistance of teachers towards technologically driven advancements within teaching in the classroom is not rare. It is suggested by Tangney and Bray (2013) that even though the affordability of mobile technology aligns with the teaching approach of social constructivist teaching, but the use of technology is overwhelmingly restricted to consumption of content which fails a conventional approach of teaching mathematics (Orlando & Attard, 2015).

Effective integration of digital technologies into teaching and learning mathematics is a complex task that requires deliberation of various elements including content, pedagogy, and student learning. The use of digital technology for mathematics teaching can be ineffective and distracting if not integrated into the learning process in a meaningful way (Adams Becker et al., 2017).

The debate about the optimal ways for teaching mathematics is ongoing. On one hand, it is argued that the teaching of mathematics should include clear details and explanation of procedure which then should be followed by practice and needed corrections (Kirschner et al., 2006). It is relatively simple to adopt this approach in online environments where there are numerous short videos that provide explanations and demonstrations and games or exercises for practice that can be sourced online easily or even created by the teachers. However, if that is the only experience that students have, then there are some threats attached to it (Kirschner et al., 2006). This form of learning may be less interesting for the students who are working by themselves. Provision of explanation and a more targeted practice that can meet an individual student's needs is hard for the teacher in this case. On the contrary, the other debate provides the argument that mathematics is learned best when mathematics tasks are solved by the students themselves; when they have a chance to explain and reason their justification and relate the different aspects of mathematics (Sullivan et al., 2020) and it is difficult to arrange this approach in an online and remote environment.

There has been an increase in the research in recent years with regards to on-site versus online learning in post-secondary education but the findings on on-site versus online mathematics courses remain scarce. In an interesting study, Ryan (2001) compared the learning experience within a classroom-based method of instruction with two distant education systems whereby students were given three options to take a course on introduction to statistics, i.e., i) by web, ii) by video-based telecourse and iii) classroom. No significant difference was shown by the results in the final grades for the distant learning courses in comparison to the conventional classrooms. It has been indicated by another study that the education quality from online mathematic courses is somewhat comparable to courses conducted face to face (Rey, 2010).

It is highlighted that the prospective teachers' skills of using computers are important for the productivity and effectiveness of the process of education. It is emphasized by Tekinarslan (2008) that it is important to have teachers with adequate knowledge in the field of computers and information literacy. As technology continues to spread, the curriculum for education faculties that educate teachers has changed the lessons on computers, and technology for instruction has increased. Nonetheless, most researchers and academicians agree that technology ought to be employed as a tool instead of an educational goal (Usta & Korkmaz, 2010). When computer software is chosen by a teacher, there is a need to focus on ease of use of the software by the children, especially whether the information is taught step by step, if the exercises are carried out easily, whether the software is interactive and if the feedbacks are appropriate (Zipke et al., 2019). Ã–zdemir (2018) stated that most teachers with high skills in using computers also have high averages of perception of the technology used in teaching mathematics.

2.3 Review of the Literature

2.3.1 Teaching Mathematics

"Didactics" have been defined by Chevallard (2005) as the science of disseminating knowledge in a social group and it studies elements of global or local praxeologies. Praxeology is made up of tasks, technologies, techniques, and theories for the justification of technologies. For didactics in mathematics, the knowledge of mathematics is acquired by means of learning and finding solutions to mathematical problems through conceptual concepts of schemes (Vergnaud, 2013). While solving mathematical problems, it is essential to reflect on the most suitable procedure and analyze and differentiate the data which favors the significant learning in students

(Trouche et al., 2016). Hence, the teachers need to be trained as well as must use the resources and tools related to mathematics didactics. Lagrange et al. (2003) addressed integrating technology in didactics of mathematics by considering four important dimensions: teacher, students, mathematics, and tools. The most efficient teachers institute pedagogical relation between the content and technology by "instrumental genesis" which is a process in which an object becomes an instrument. The instrumental genesis in teaching of mathematics by means of technology is a multifaceted process which requires time (Trouche et al., 2016).

In general, the studies that examine technologies in mathematics didactics have mostly focused on the digital tools, objective of activities, and the level of incorporation of technology in teaching of mathematics (Bray & Tangney, 2017). However, from the beginning, a disparity has been existent with respect to theoretical frameworks for designing technological tools and realizing research with these tools that makes it complicated to generalize conclusion. The role of a math teacher is vital for integrating ICT in teaching mathematics appropriately. It has been mentioned that incorporating ICT into practices of teaching is conditioned by a variety of factors such as quantity and characteristics of technological resources available (Gui et al., 2018).

Despite the importance of technology, the teachers normally have a low or mid-level of proficiency in digital technologies, however the attitude, perception and methodological use of technologies are factors that ought to be taken in account as well as the age and teaching experience of the teacher (Liu et al., 2020). When concerning mathematics, particularly, it is important to remember the importance of the component of embodiment. The blackboard teachers were compared by the body teacher by Chen et al. (2019). Whereas the blackboard teachers manage their communication by means of symbolic language and written words where the

blackboard is at the spotlight always because the teacher is using it for writing and underlining a written part. On the other hand, for body teachers, their communication is typified by a rigorous use of metaphorical and iconic gestures that involve figurative and imaginative components mainly (Maksimenko & Klimenko, 2015).

There are several ways for representation of mathematical objects such as iconic representations and formal mathematical language, etc. The process of learning which leads the students towards recognition of the same mathematical objects viewed from diverse points of view is termed as “objectification” (Radford, 2005). To teach a discipline such as mathematics which is comprised of abstract objects that cannot be touched, it often requires using metaphors for achieving the objectification of the topics in mathematics that can be understood by teachers in terms of something that they know already (Cassibba et al., 2020).

According to “embodied mind” theorists (Lakoff & Núñez, 2000), physical objects or situations are used by people to understand complicated topics thoroughly. The “conceptual metaphors” are specifically used by them which is not just a simple metaphor in a more poetic sense but instead it is a cognitive mechanism which projects a source domain’s inferential structure onto a target area (Glucksberg et al., 1993). In the sense of mathematics, it is like a map between the two domains, i.e., the source domain and the target domain whereby it preserves all the properties of those two elements. When a metaphor is being used, it is important that body gestures are used by the teachers to help their students imagine the novel mathematical objects in their min in terms of the objects with which the students are familiar and can visualize and control, using different representations, for example metaphors, in combination with formal language of mathematics is useful because it has been demonstrated by several

studies that the students find it difficult to understand the objectification process (Santi, 2011).

It is possibility for the dimension of body teacher to be lost in favor of blackboard teacher when transition takes place from a conventional classroom teaching which involves presence into distance learning or E-Learning. Those teachers that are tied to their blackboard and represent mathematical objects by using a formal mathematical language now find themselves lacking their "safe place". The pedagogical and mathematical knowledge as well as their beliefs are related to the teachers' safe place and the ways in which they feel comfortable to teach. Almost three decades ago, in a famous paper by Shulman, i.e., "Those who understand" pointed out the important role of integration of pedagogical and mathematical knowledge as crucial (Shulman, 1986). Carrillo-Yañez et al. (2018) introduced a Mathematical Teacher's Specialized Knowledge (MTSK) model which was inspired by research of Ball & Bass (2009) on MKT, i.e., mathematical knowledge for teaching. The contributors of the MTSK model made discussion on the exact images by which the practice of teachers can be interpreted taking into consideration those aspects that influence it the most based on the knowledge primary to this practice (Carrillo-Yañez et al., 2018). Within the MTSK model, there are two domains, i.e., the pedagogical content knowledge and mathematical knowledge which is then divided into a number of subdivisions.

As can be noticed in the Figure 1 (Carrillo-Yañez et al., 2018), the teacher's beliefs lie at the center because of the close relation between that of the two domains of knowledge and beliefs. "Beliefs" in this case means less articulate set of truths, conceptions, mental images, preferences, and meanings of the teachers (Thompson,

1992), which has a strong influence on what happens within the class and consequently on the learning of students.

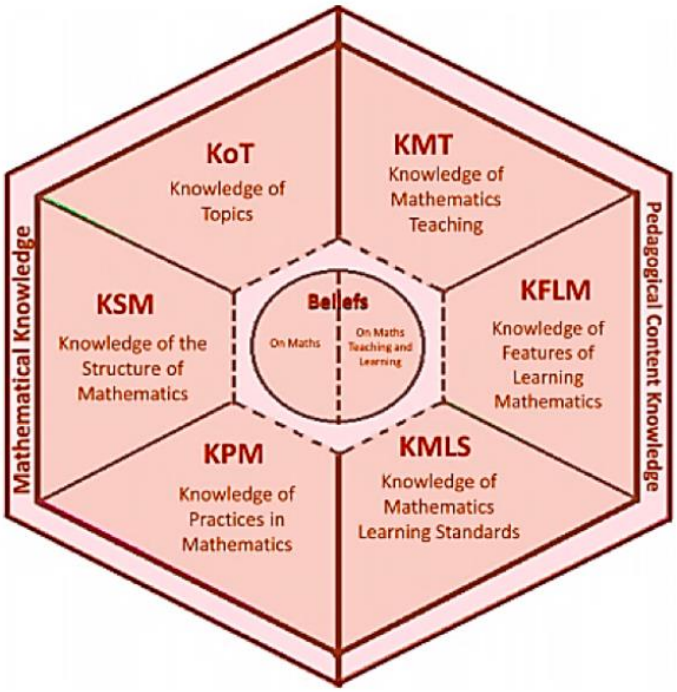

Figure 1: Mathematical Knowledge

The beliefs in MTSK model are distinguished (even though the boundary is weak) as the belief of the teachers about math and their belief about learning and teaching of math. This belief is a mediator between the knowledge and its practice. The teacher's beliefs and practices were studied by Fukawa-Connelly et al. (2016) at the tertiary level who found an attention-grabbing contradiction between the belief of professors about mathematical teaching and that of their practice in classroom. As an average pedagogical practice, 85% of the professors used lectures whereas 82% of the professors answered that the best way of teaching was "lecturing". However, it was agreed by 56% those students learn more when they perform mathematical work in the class (in addition to attending the lecture and taking notes), which shows a disparity between the beliefs with regards to student learning and the actual practice of teaching.

Even when a constructivist approach is recognized by the teachers as more effective for learning in the students, they continue using methodology oriented on transmission. If this disparity is significant in a normal situation, then it happens to be more serious in the case of emergency such as the one stimulated by COVID-19 that has led to sudden immersion into the concept of distance teaching through online mediums (Cassibba et al., 2020).

According to Niess et al. (2009), Technology, Pedagogy, and Content Knowledge (TPACK), has suggested to use TPACK as an intersection and connection among education. Moreover, TPACK relating to mathematics teachers offers guidelines for strategy and thinking process. Niess et al. (2009) observed mathematics teachers for almost 4 years for using spreadsheets and integrating them into classrooms and results where teachers were able to progress and achieve targets using five-stages development process that were: 1) recognizing, 2) accepting, 3) adapting, 4) exploring, and 5) advancing.

2.3.2 Attitude and Perception of Teachers Towards ICT

The teachers at elementary school mathematics are influential to the development of effective and meaningful ways of learning, thinking, and doing mathematics in students and to support the success of the students in mathematics and its related disciplines in the higher grades as well as professional aspects. The research on mathematic teachers is continuously focused on teachers at elementary schools in a number of ways with emphasis on their learning and pedagogical knowledge and beliefs about mathematics.

Some research as Chapman (2017) focused on studies oriented around deficiency that highlighted what is not known by the teachers and need to be fixed in

the education and/or professional development programs of the teachers. However, this way of educating teachers is more damaging than being supportive. The studies should instead recognize the importance of a teacher's personal knowledge and experience regarding mathematics that could provide a meaningful foundation for their growth and learning in teaching mathematics.

The teachers must be understood in terms of their knowledge and instructional approaches. Understanding elementary mathematics schoolteachers in this way is important for addressing the intricacies and encourages autonomy in their learning of being able to successfully engage their students in valuable learning of mathematics as well as creating innovative learning environment for teaching mathematics (Chapman, 2017).

The perception held by the teachers towards computer technology is one of the major factors that influence the use of technology (Liu et al., 2020). The attitudes were classified into three dimensions, i.e., "Active", "Behavioral" and "Cognitive" (Maio al., 2018). On the other hand, the conditioning factors are classified into the categories of "Knowledge", "Skills" and "Attitude" (Spiteri & Chang Rundgren, 2018). However, the way teachers perceive the support drives the integration of pedagogical resources of ICT. For improving the perception regarding technology, the most influential model for motivation is self-determination and in this sense the support and digital self-efficacy perceived and provided by the educational institute can improve the teachers' motivation and commitment for designing innovative material. Provision of training to teachers is another major factor that can affect the perception with regards to incorporation of technology and digital mediums into teaching mathematics and other subjects (Sánchez-Prieto et al., 2019).

It is postulated under available literature that using ICT properly can benefit collaborative work (Vanbecelaere et al., 2020) as well as learning in students, hence impacting their academic performance (Dalby & Swan, 2018). Nonetheless, the teachers continue using conventional methodologies with boards and textbooks (Dostál et al., 2017) and make use of technology in a limited matter, mainly for the purpose of searching for information on the internet or for managerial purposes (Alemayehu & Natarajan, 2018).

Concerning Interactive White Boards (IWBs), they are used mainly as a tool for delivery of lesson in the classroom and not by taking into consideration their pedagogical potential (Chen et al., 2020). Such a teacher-centered approach towards teaching may not encourage collaborative and participatory work by the students and neither it takes advantage of the IWBs' innovative functions (Aflalo et al., 2018).

ICT strengthens creative and cognitive abilities along with communication skills, but no value is added by the technology alone. A high level of performance can be observed when the teacher can manage to bring pedagogical, technological and integration efficiencies within the three areas (OECD, 2015b). How much ICT and online mediums prove successful for education depends a great deal on the digital autonomy of teachers owing to their professional development, digital competence and training acquired (Kundu et al., 2020). It has however also been observed that technology has pessimistic effects on the process of teaching-learning. There is an effect on teaching process among other factors, from the negative impact of "techno-stress" caused to the teachers which is the stress associated with use of technology.

The techno-stressors related with uncertainty, insecurity, complexity, overload, and invasion significantly lead to teacher burnout and reducing their professional performance (De Brabander & Glastra, 2020). Such affects have greater impact

especially on the older teachers however no difference have been noticed in gender. On the other hand, the effects of techno-stressors are significantly reduced by self-efficacy (Li & Wang, 2020).

Some of the previous findings exposed a negative impact of using ICT methods which require students' active participation, however the negative effect experienced by the students can be reduced significantly if the teachers have a high digital competence level (Wang et al., 2020).

2.4 Summary

One thing that is evident from the review of literature is that there is very scarce literature on the perception of teachers with regards to teaching mathematics online, especially with respect to elementary school learners. This literature review provided a good basis for the use of technology in mathematics education as it reports on how it can benefit the student. The literature review suggests that using ICT in teaching can help students be more cooperative and increase their learning. However, there seems to be a lack of support in terms of helping teachers to efficiently integrate ICT method in their teaching. Many teachers have different levels of competencies and proper training is required so that they can adopt digital technology. Many teachers have different beliefs when it comes to the use of ICT in teaching, and many are hesitant to leave the conventional methods behind. The institutions need to help the teachers understand the importance of ICT in education and help them create more innovative curriculum. Moreover, research suggests that students can be more benefited by ICT assisted learning if the teachers are more competent in ICT.

Chapter 3: Methodology

3.1 Overview

In this chapter, the researcher explained why the collected data are significant to the study. In addition, the researcher set out the instrument and procedures by which data was analyzed. In addition, the validity and reliability of the questionnaire were discussed along with the analysis of data.

A questionnaire approach was used in this study to mainly set out an understanding of teachers' perceptions about mathematic online teaching for elementary school students and how online teaching affected and influenced teachers to improve themselves and enhance their knowledge.

Questions that guided this research study are:

1. What are the perceptions of elementary teachers towards teaching mathematics online?
2. What are the obstacles encountered by elementary teachers when teaching mathematics online?
3. What are the elementary teachers' preferences for future for teaching mathematics online?

3.2 Context of the Study

This study was done on the third term of the academic year 2020-2021 for four working weeks. The study was sent to multiple private and governmental schools in Al Ain city in the United Arab Emirates. It was sent to mathematics teachers around Al Ain schools that teach grades 1 to 5 the elementary section.

3.3 Research Design

This study used descriptive quantitative questionnaire design to find out teachers' perceptions regarding mathematics online teaching for elementary school and as data collection and the participants were teachers from grades 1 to 5 of private and governmental schools. In addition, the questionnaire for the teachers was developed along with the assistance and supervision from faculty members of the United Arab Emirates University.

Thus, in this research, teachers' perceptions about teaching mathematics online for elementary school and the ability to use online resources to effectively accomplish their targets were quantitively measured. Moreover, the data that was collected through the qualitative questionnaires provides needed information about teachers' views, regardless on why and how the teachers noticed the solution and ways that could resolve their issues and that's why qualitative data was used to provide information of why and how and what was needed from practices and resources that assisted teachers in teaching online.

3.4 Population and Participants

This research studied teachers' perceptions towards teaching mathematics online for elementary schools in Al Ain. The sample of the study included 90 teachers from Al Ain schools. Seventy-five female teachers and fifteen male teachers. The participants have different level of education, years of experience and even different grade levels. It was mentioned through the questionnaire that it was confidential, and their personal data would not be shared with anyone, and it won't even affect them. Moreover, it was mentioned the purpose of the study clearly. Ethical request was

mentioned and sent to participants through emails and even was mentioned in the questionnaire.

3.5 Instruments

In this study, a questionnaire was used, and it had four sections (demographics information, teachers' perceptions of teaching mathematics online, obstacles of teaching mathematics online, and teachers' preference for the future) (Figure 2). Prior to the development of the questionnaire, the researcher has reviewed a thorough of related literature about mathematics teachers' opinions. Then, the researcher drafted the items of the questionnaire and organized them in four sections mentioned earlier. The items in the questionnaire were in accordance with the research questions and the purpose of the study. The researcher started initially with almost 40 items in the questionnaire which were reduced as some items were eliminated and some items were modified. The final draft of the questionnaire had 30 items excluding the demographic information.

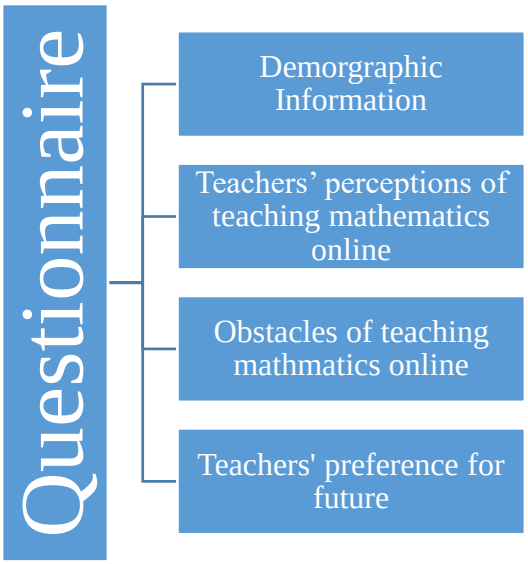

Figure 2: Survey Instrument

3.6 Data Collection

After finalizing the questionnaire and establishing the reliability and validity of the instrument, the researcher started to prepare the questionnaire using online google forms and then launching it to start receiving responds. In addition, link of the questionnaire was shared, and participants started answering and it was open for almost 30 days, 90 responds were received, and the questionnaire was closed after finishing the deadline.

3.7 Validity of the Questionnaire

The researcher carefully assessed both the validity and reliability of the study instrument to ensure its soundness and consistency. With regard to the validity of the instrument, a panel of two educators and three university professors reviewed the questionnaire to determine its relevance and suitability for the objective of the study. The panel members were asked to provide comprehensive feedback regarding the word choice, types, and number of questions. Upon receiving reviewer's comments, the researcher revised the questionnaire by deleting some items, splitting others, and rewording some statements. After the revision was complete and approved by the thesis supervisor, the researcher pilot tested the questionnaire by distributing 30 questionnaires to 30 elementary teachers. Participants from the pilot phase completed the questionnaire within a reasonable amount of time and they believed that the questionnaire was clear enough to understand and easy to answer. Teachers who took part of the pilot testing were excluded from the final questionnaire sample.

3.8 Reliability of the Questionnaire Procedures

The reliability of the study instrument is one of the most significant characteristics of study instruments. The scale reliability means the consistency between the collected results through re-applying the same scale of cognitive flexibility to the same subjects under the same conditions or similar conditions as possible. As was mentioned earlier, the researcher applied the instrument in (30) pilot sample and used the Cronbach Alpha coefficient method to measure the reliability of the current study instrument. The instrument' overall Cronbach Alpha value was found to be 0.79. Additionally, Cronbach's Alpha for each field of the questionnaire was calculated (Table 1).

Table 1: Cronbach's Alpha for Each Filed of the Questionnaire

Domain	Cronbach's Alpha
Perceptions of teaching mathematics	0.80
Obstacles of teaching mathematics	0.83
Teachers' Preference for Future	0.75

Table 1 shows the values of Cronbach's Alpha for each domain of the questionnaire and the entire questionnaire. The values of Cronbach's Alpha were in the range from 0.75 and 0.83. Thereby, it can be said that the researcher proved that the questionnaire was valid, reliable, and ready for distribution for the population sample.

3.9 Ethical Considerations

Prior to the implementation of the study, the researcher applied through the Office of Research Ethics at United Arab Emirates University for ethical approval. Ethical approval was obtained with university referenced ERS_2021_7295. The details of the study were described in a detailed report that was sent to the participant along with the questionnaire.

The participants in this study were equally treated with confidentiality and approval was taken once they started the questionnaire and to use their data as a part of the study. Before signing the consent letter, the participants were informed about the study's purpose and its results.

3.10 Data Analysis

The data that was collected and used to determine the effects and changes in teachers' perceptions of teaching mathematics online for elementary schools. Moreover, data was generated from 37 questions that were divided into three sections. Section one contained 15 questions along with 5 personal information, while section two had 13 questions and section 3 had 4 questions. In addition, descriptive statistics produced significant information from the raw data. Then, descriptive statistics were used to find out the standard deviation, and SPSS has been used to analyze results from the questionnaire.

3.11 Summary

This chapter described the methods and procedures of the study to provide insights into the teachers' perceptions on teaching mathematics online for elementary schools. At the start of the chapter, it was mentioned which research design was used

to perform the research, then participants were presented, and the number of participants was included. After that, the instrument that was used in the research was explained in detail. Moreover, a detailed explanation of the procedures was mentioned, and the validity and reliability of the questionnaire were tested and established. Ethical issues were mentioned and how the researcher attained the approval and data analysis was briefly explained.

Chapter 4: Results

4.1 Introduction

This chapter shows the results of the study that was carried out in the previous chapter. This study was to find out teachers' perceptions towards teaching mathematic online for elementary schools in Al Ain. The study weighed how teachers reacted towards online learning. And the study showed if there is a significant difference between teacher's answers. The study used a questionnaire method. For all statistical analysis, SPSS 26 was used.

4.2 Distribution of the Participants of the Study

Using the (SPSS) program, the responses of the study sample were analyzed as shown in Table 2.

Table 2: Distribution of the Participants of the Study

Variables	Variable items	Frequency	Percentage %
Years of Experience	less than 5	31	34.4
	6-10	34	37.8
	11-15	14	15.6
	More than 15	11	12.2
Educational level	Bachelor's	74	82.2
	Master's	14	15.6
	Doctorate	2	2.2
Gender	Male	15	16.7
	Female	75	83.3
	Total	90	100.0

4.3 Analysis of Research Questions

4.3.1 Normality Test

Table 3 showed the results of the normality test of the variable of the main sections of the questionnaire.

Table 3: Normality Test of the Variables

	Kolmogorov-Smirnov(a)			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Perceptions of teaching mathematics	0.077	90	0.200(*)	0.975	90	0.084
Obstacles of teaching mathematics	0.083	90	0.174	0.977	90	0.107
The teachers' Preference for the Future	0.092	90	0.059	0.978	90	0.126

* This is a lower bound of the true significance.
a Lilliefors Significance Correction

The collected data from elementary mathematics teachers was grouped into three categories: teachers' perceptions of teaching mathematics online, Obstacles faced by elementary teachers during online teaching, and teachers' preference for the future. Prior to the data analysis, Kolmogorov-Smirnov and Shapiro-Wilk tests were performed to test whether the data were normally distributed. The reason for such an analysis is essential that it helped us decide whether to use parametric or non-parametric tests. Table 3 displays the results of normality tests performed. All three categories were normally distributed (p-value > 0.05). Based on the normality of these categories, the researcher decided to use parametric tests (t-test and ANOVA).

It is evident from the above Table 3 that all the statistical significance values were greater than the level of statistical significance ($\alpha = 0.05$), which indicates that these variables follow a normal distribution, so parametric tests were used to show the effect of the independent variables (p-value < 0.05).

4.3.2 Question 1: What Are the Perceptions of Elementary Teachers Towards Teaching Mathematics Online?

To answer the first question of the study, Means and Standard deviation of the perceptions of elementary teachers towards teaching mathematics online were calculated as shown in Table 4.

Table 4 shows that Item 1 "I'm able to use different digital technologies for teaching mathematics" receives the highest mean (4.43), while item 11 **"**Online teaching is more suitable way to teach mathematics for elementary students than face-to-face mode" was ranked last with mean of (2.89). This table also shows that the perceptions of teaching mathematics mean as a whole was (4.00).

Table 4: Means and Standard Deviations of the Perceptions of Elementary Teachers Towards Teaching Mathematics Online, Ranked in a Descending Order

Rank	NO.	Item	Means	SD
1	1	I am able to use different digital technologies for teaching mathematics.	4.43	0.835
2	2	I am able to adapt my lessons with online teaching to improve student learnings.	4.39	0.760
2	3	I am able to use digital technologies to represent mathematical ideas.	4.39	0.817
2	5	I am able to use technology to support students' learning for the lesson.	4.39	0.870
5	4	I am able to use digital technologies to solve mathematics questions.	4.37	0.800
6	6	I can integrate mathematical content, digital technologies and teaching approaches to support students' learning of mathematics.	4.27	0.872
7	9	Online teaching has increased my skills with technologies for teaching mathematics.	4.21	0.954
8	10	Online teaching helped me in using more varieties of methods of teaching mathematics than face-to-face teaching.	4.14	0.943
9	15	Online teaching requires more time and availability than traditional teaching.	4.11	1.116
10	13	Online teaching increased my workload compared to the traditional teaching.	3.97	1.175
11	7	I am more effective in the face-to-face classroom than online sessions.	3.91	1.242
12	14	Online teaching is more stressful than traditional teaching.	3.84	1.271
13	8	Online teaching has a positive effect over student's achievements.	3.37	1.166
14	12	Online teaching made me more confident in teaching mathematics than face-to-face teaching.	3.33	1.324
15	11	Online teaching is more suitable way to teach mathematics for elementary students than face-to-face mode.	2.89	1.361
		Perceptions of teaching mathematics	4.00	0.549

4.3.3 Question 2: What Are the Obstacles Encountered by Elementary Teachers When Teaching Mathematics Online?

To answer the second question of the study, means and standard deviation of the obstacles encountered by elementary teachers when teaching mathematics online were calculated as shown in Table 5.

Table 5: Means and Standard Deviations of the Obstacles Encountered by Elementary Teachers When Teaching Mathematics Online, Ranked in a Descending Order

Rank	NO.	Item	Means	SD
1	13	School resources were available during online teaching	4.13	0.824
2	10	As a teacher, I had enough training by my school to teach mathematics online	4.07	0.946
3	11	Tools that are used for online teaching are flexible	4.04	0.911
4	12	Tools that are used for online teaching are easy to understand.	3.99	0.841
5	9	As a teacher, instructional preparation time has increased due to online teaching.	3.74	1.186
6	7	As a teacher, I need to learning new teaching methods in order to teach mathematics online.	3.70	1.213
7	6	As a teacher, teaching mathematics via online makes me more stressful	3.68	1.225
8	2	Student's way of communication has not improved due to online teaching.	3.58	1.199
9	3	Student's learning of mathematics has become harder in online classes than traditional classes.	3.57	1.209
9	4	Students have learned less during online teaching than traditional classroom.	3.57	1.307
11	1	Student's motivation in mathematics has decreased due to online teaching.	3.50	1.318
12	5	Student's participation in mathematics class has declined because of online teaching.	3.43	1.350
13	8	As a teacher, I faced difficulties in using online resources while teaching mathematics online.	2.93	1.347
		Obstacles of teaching mathematics	3.69	0.671

Table 5 shows that Item 13 "School resources were available during online teaching" receives the highest mean of (4.13), while item 8 "As a teacher, I faced difficulties in using online resources while teaching mathematics online" was ranked last with mean of (2.93). This table also shows that the Obstacles of teaching mathematics mean was (3.69).

4.3.4 Question 3: What Are the Elementary Teachers' Preferences for Future for Teaching Mathematics Online?

To answer the third question of the study, frequencies, and percentage of the elementary teachers' preferences for future for teaching mathematics online were calculated as shown in Table 6.

Table 6: Frequencies and Percentage of the Elementary Teachers' Preferences for Future for Teaching Mathematics Online, Ranked in a Descending Order

Rank	NO.	Item	Count	%
1	2	School administration provided me with needed support during online teaching	79	87.8
2	3	School administration provided me with the needed training to teach online.	77	85.6
3	1	If I have a choice, I prefer to teach mathematics face-to-face more than online	69	76.7
4	4	I enjoy teaching mathematics online	58	64.4

Table 6 shows that Item 2 "School administration provided me with needed support during online teaching" receives the highest frequency of (79) with a percentage of (87.8%), while item 4 "I enjoy teaching mathematics online" was ranked last with frequency of (58), with a percentage of (64.4%).

The following questions, indicate the statistical significant differences of each part of the questionnaire.

1. Are there any statistical significant differences ($\alpha = 0.05$) in the perceptions of elementary teachers and obstacles of teaching mathematics towards teaching mathematics online due to educational level?

To find out whether there are statistically significant differences ($\alpha = 0.05$) in the perceptions of elementary teachers and obstacles of teaching mathematics towards

teaching mathematics online due to educational level, independent sample t-test analysis was conducted, and the results are shown in Table 7.

Table 7: t-test Results of Educational Level

	Educational Level	N	Mean	Std. Deviation	t	df	Sig. (2-tailed)
Perceptions of teaching mathematics	Bachelor's	74	4.00	0.554	-.094	88	0.925
	Graduate	16	4.01	0.541			
Obstacles of teaching mathematics	Bachelor's	74	3.62	0.685	-1.996	88	0.049
	Graduate	16	3.99	0.517			

* Significant at the 0.05 level

Table 7 shows:

- There are no statistically significant differences at (α= 0.05) in the perceptions of teaching mathematics due to Educational Level variable.
- There are statistically significant differences at (α= 0.05) in the obstacles of teaching mathematics due to Educational Level variable in favor of Graduates.

2. Are there any statistically significant differences (α= 0.05) in the perceptions of elementary teachers and Obstacles of teaching mathematics towards teaching mathematics online due to Gender?

To find out whether there are statistically significant differences (α= 0.05) in the perceptions of elementary teachers and obstacles of teaching mathematics towards teaching mathematics online due to Gender, Independent sample t-test analysis was conducted, and the results are shown in Table 8.

Table 8: t-test Results of Gender

	Gender	N	Mean	Std. Deviation	t	df	Sig. (2-tailed)
perceptions of teaching mathematics	Male	15	3.91	0.505	-0.725	88	0.470
	Female	75	4.02	0.559			
Obstacles of teaching mathematics	Male	15	3.91	0.659	1.436	88	0.155
	Female	75	3.64	0.668			

* Significant at the 0.05 level

Table 8 shows:

- There are no statistically significant differences at (α= 0.05) in the perceptions of teaching mathematics due Gender variable.

3. Are there any statistically significant differences (α= 0.05) in the perceptions of elementary teachers and obstacles of teaching mathematics towards teaching mathematics online due to Years of Experience?

To find out whether there are statistically significant differences (α= 0.05) in the perceptions of elementary teachers and Obstacles of teaching mathematics towards teaching mathematics online due to Years of Experience, Independent One-way ANOVA analysis was conducted, and the results are shown in Table 9.

Table 9 shows:

- There are no statistically significant differences at (α= 0.05) in the perceptions of teaching mathematics due to Years of Experience variable.

Table 9: One Way ANOVA Results of the Years of Experience

		N	Mean	Std. Deviation	F	Sig.
Perceptions of teaching mathematics	less than 5	31	4.12	0.652	2.427	0.071
	6-10	34	3.92	0.435		
	11-15	14	3.75	0.580		
	More than 15	11	4.22	0.370		
	Total	90	4.00	0.549		
Obstacles of teaching mathematics	less than 5	31	3.62	0.698	0.226	0.878
	6-10	34	3.70	0.611		
	11-15	14	3.80	0.757		
	More than 15	11	3.71	0.729		
	Total	90	3.69	0.671		

* Significant at the 0.05 level

4.4 Summary of the Results

The survey focused on three basic questions whereby each question included several statements that the respondents had to respond to by using a Likert scale on a scale of 1 to 5 (1= strongly disagree and 5= strongly agree).

The first question investigated the perception held by the teachers around the practice of teaching mathematics online. In summary, most respondents agreed (Strongly agreed and agreed) to the notion that they can make use of various digital technologies, adapt their lessons, make use of technology to solve mathematical problems, support their students and their learning, and improved their digital skills in the process. On the other hand, they believe that the online teaching has increased their workload and is more stressful and time taking compared to face-to-face teaching. Whether online teaching of mathematics helps to improve student's achievement and whether it is a good method for teaching math to elementary school students; there happens to be a noticeable difference between the answers.

The second question inquired about the obstacles that are faced by the elementary teachers when they teach mathematics online. Whereas the teachers believe online teaching of mathematics to have some benefits despite the stress and consumption of time, their response to the statements regarding achievement of students in the first question shows concern. The same is reflected in responses to the statements under question two. Most teachers agree (strongly agree and agree) that the motivation and communication in students has not improved and in fact decreased and the students seem to learn less which adds to the stress faced by the teachers as they have to look for more and more methods of teaching mathematics that can be easily understood by the students even though the teachers had appropriate amount of training to teach mathematics online.

The third part investigates teachers' preference for the future. Despite the majority agreeing to the notion that they have been supported by the school through resources and training and enjoying the online teaching, they would still prefer to teach mathematics face to face in the future.

Chapter 5: Discussion, Conclusions and Recommendations

5.1 Overview

This final chapter discussed the implications of the findings from the study. It included a discussion of the survey results in detail and in comparison, with the body of knowledge, i.e., the literature review in chapter two. It also included the limitations of the study and implications with regards to research in the future.

5.2 Discussion of the Results

As mentioned in chapter four summary, there were three main questions (each containing a set of questions and statements) that were inquired within the survey. The survey results were collected from 90 respondents in total. Mentioned below are the results of all survey questions along with the discussions.

5.2.1 Part 1 Results: Teachers' Perceptions of Teaching Mathematics Online

Below are the results of questions from 1 to 7 in Figures 3 to 9.

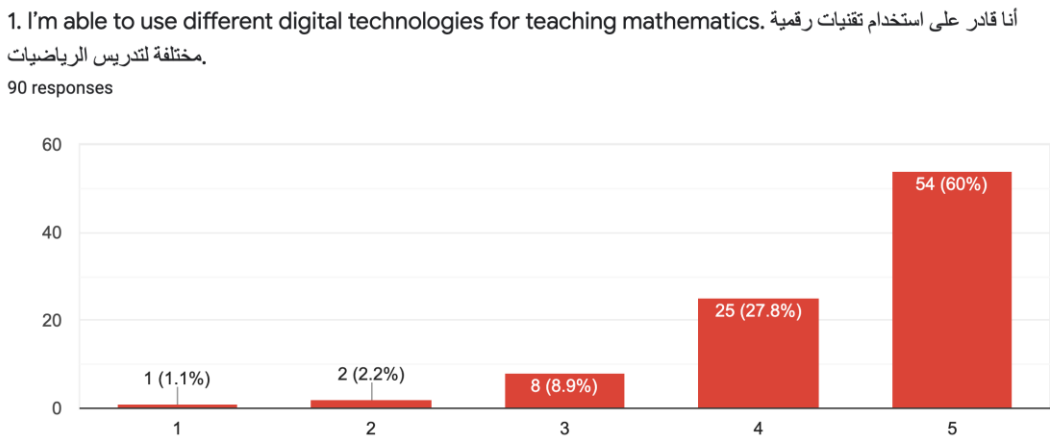

Figure 3: Question 1 of Teachers' Perceptions of Teaching Mathematics Online

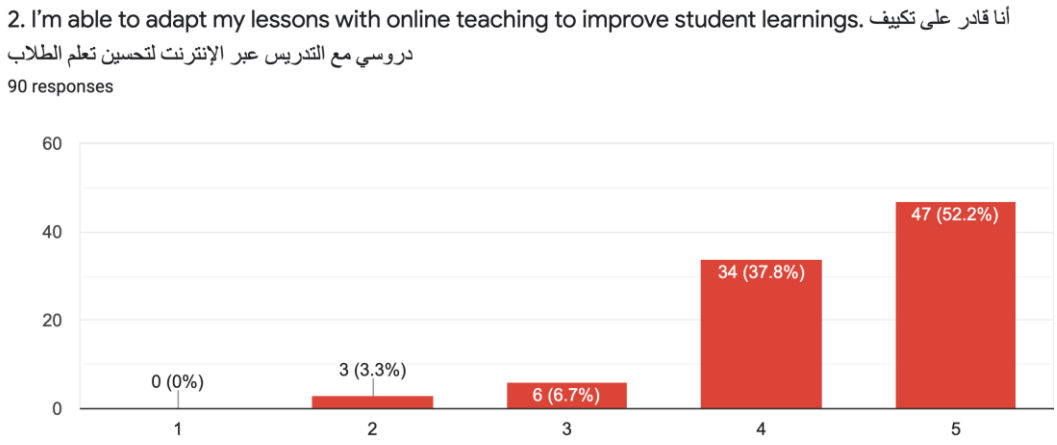

Figure 4: Question 2 of Teachers' Perceptions of Teaching Mathematics Online

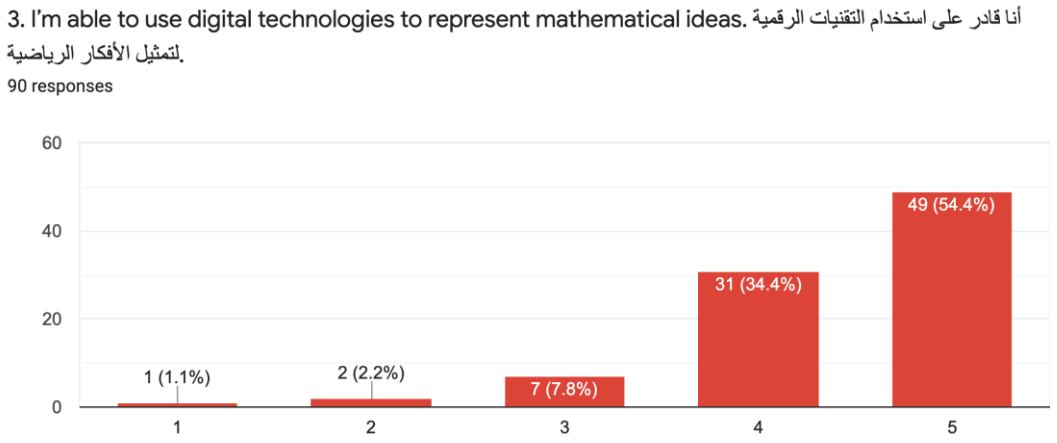

Figure 5: Question 3 of Teachers' Perceptions of Teaching Mathematics Online

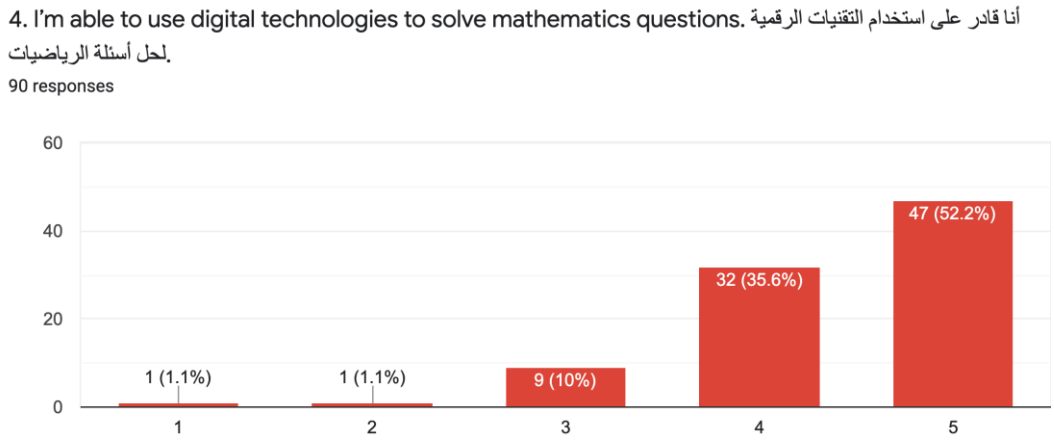

Figure 6: Question 4 of Teachers' Perceptions of Teaching Mathematics Online

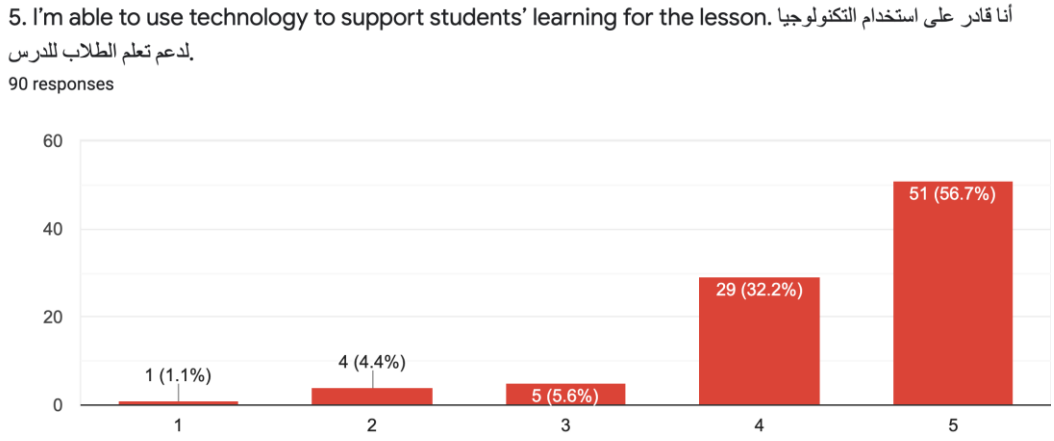

Figure 7: Question 5 of Teachers' Perceptions of Teaching Mathematics Online

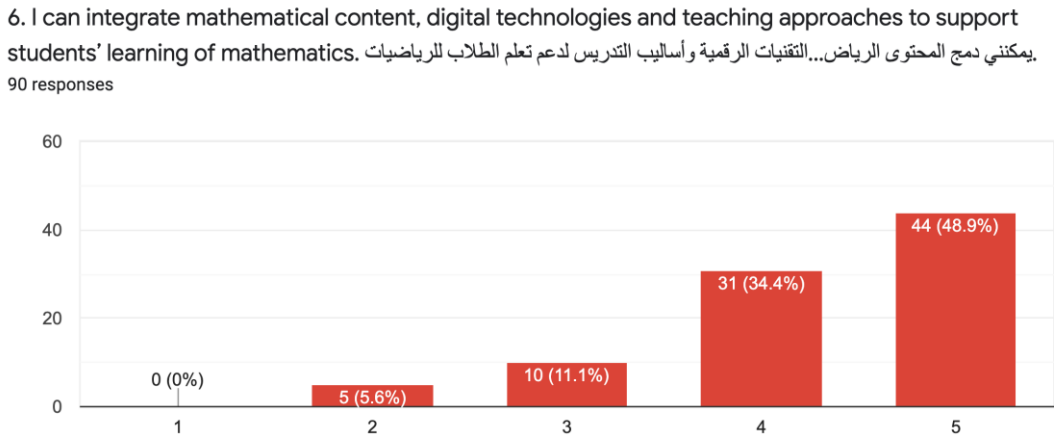

Figure 8: Question 6 of Teachers' Perceptions of Teaching Mathematics Online

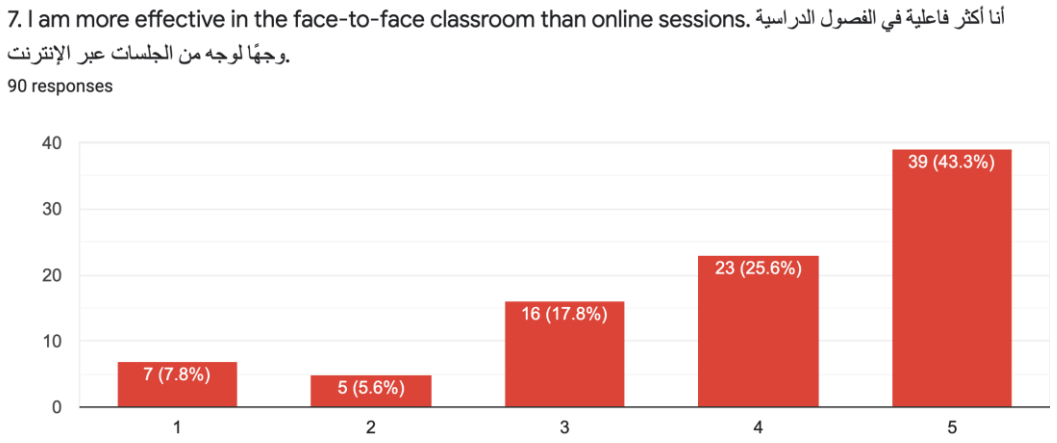

Figure 9: Question 7 of Teachers' Perceptions of Teaching Mathematics Online

The first 7 questions attempt to evaluate the perception of elementary school teachers with regards to the use of digital technology and online classes for teaching online. The responses to these 7 questions show a more positive perception held by the teachers in this regard. In response to the first 7 questions/statements, i.e., i) being able to use different technologies for teaching mathematics, ii) adapting lessons to online teaching for student's learning, iii) being able to use different digital technologies for

presenting mathematical ideas, iv) using digital technologies for solving mathematical problems, v) using technology to support student learning, vi) integrating mathematical content with digital technologies and teaching approaches, and vii) being more effective in online teaching than classrooms; the majority of the respondents strongly agreed to the statements/questions. Most respondents strongly agreeing or agreeing to the statements imply that in terms of their perception about the use of technology and its benefits, their general perception is positive.

The previous questions investigated whether the methods of online teaching for math is perceived to be advantageous by the teachers for their personal use. The following questions explore other aspects, i.e., whether the teachers perceive online teaching of math to be equally beneficial and easy for the students or not.

Below are the results of question 8 in Figure 10.

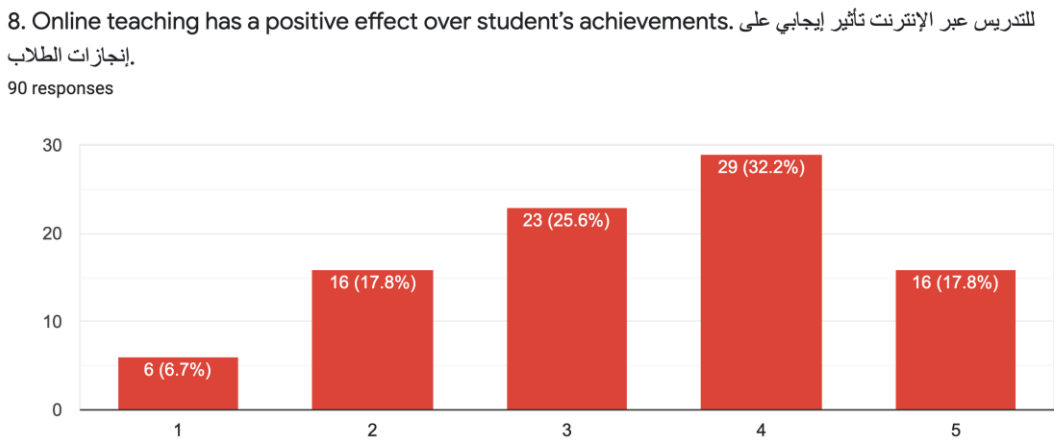

Figure 10: Question 8 of Teachers' Perceptions of Teaching Mathematics Online

When inquired about the impact of online teaching on the students' achievements, there is a wide spread of responses. Even though half of the respondents, i.e., 50% in total still agree (32.2% agree and 17.8% strongly agree) that the online teaching has a positive effect on achievements of students, it is also noticeable that

50% of the respondents in total perceive this statement to be disagreeable or uncertain (hence the response in neutral). The neutrality or disagreement to the statement could be due to several reasons such as the teachers being unsure whether student achievements are low because of online teaching or other reasons, etc.

Below are the results of questions from 9 to 10 in Figures 11 to 12.

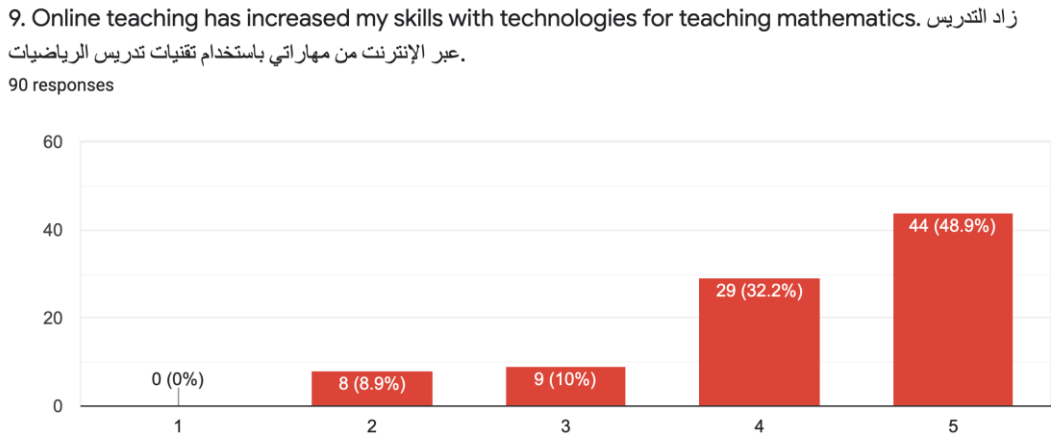

Figure 11: Question 9 of Teachers' Perceptions of Teaching Mathematics Online

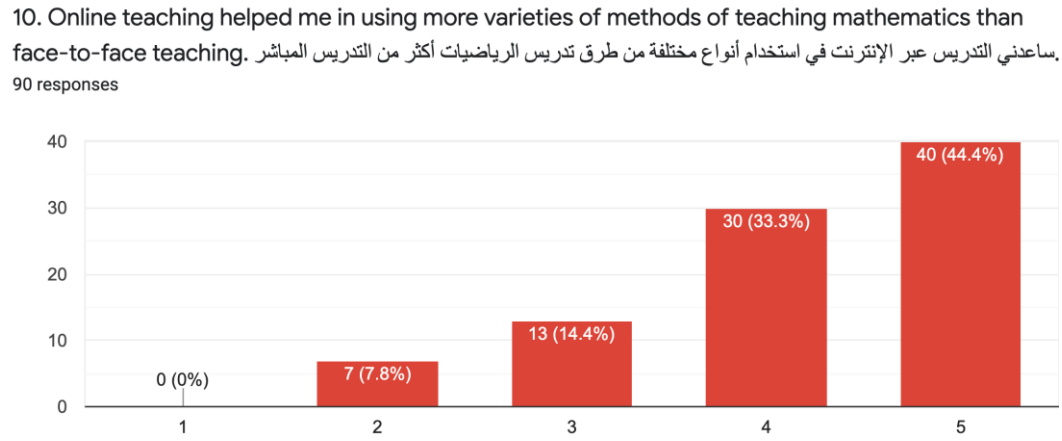

Figure 12: Question 10 of Teachers' Perceptions of Teaching Mathematics Online

The statement no. 9 and 10 again inquire about the perception of the teachers with regards to themselves and the online teaching of mathematics. In response to both the statements, i.e., i) online teaching has increased my skills with technologies for teaching mathematics and ii) online teaching helped me to use more variety of methods for teaching mathematics in comparison to physical classroom; a majority of respondents agree to the statements. According to these statements, the online teaching of mathematics is perceived by the teacher as an opportunity to upskill in digital technologies and which can be applicable in other subjects or areas of teaching as well.

Below is the result of question 11 in Figure 13.

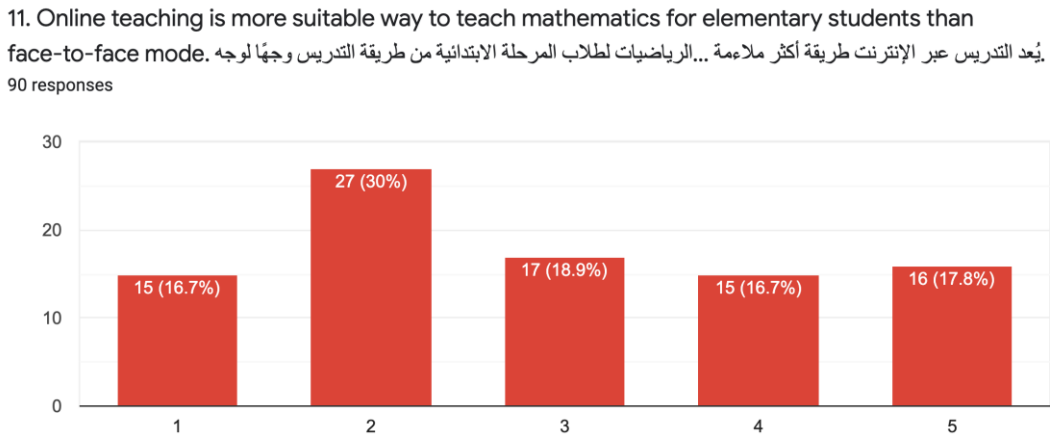

Figure 13: Question 11 of Teachers' Perceptions of Teaching Mathematics Online

The previous statements showed positive perceptions of teachers with regards to themselves and online teaching of mathematics according to the responses. However, despite those positive perceptions, the response to statement no. 11 shows that teachers do not perceive online teaching to be a more suitable way of teaching mathematics to students at elementary school in comparison to teaching mathematics face to face. It means that if an approach or methodology is good for the teacher, it does not mean that it is necessarily good for the students too.

Below is the result of question 12 in Figure 14.

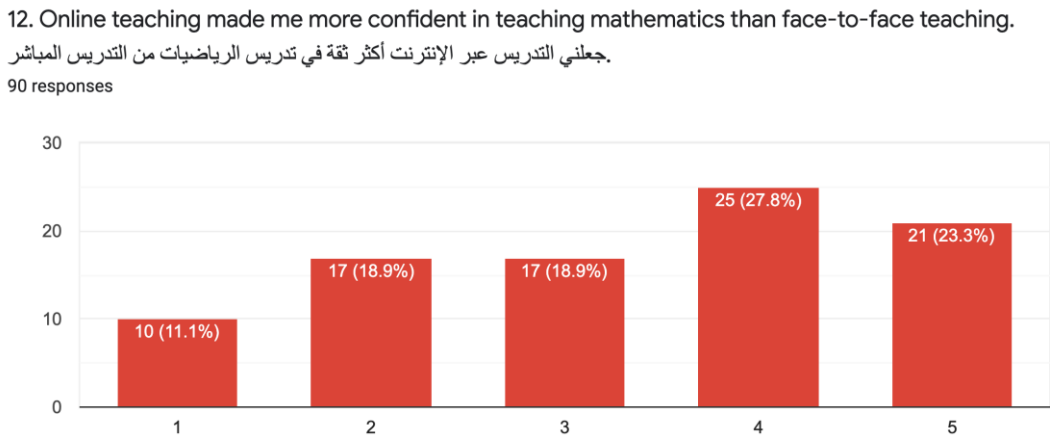

Figure 14: Question 12 of Teachers' Perceptions of Teaching Mathematics Online

Fifty percent of the respondents perceive an increase in their confidence level for teaching math because of online teaching whereas the other 50% either disagree or feel neutral.

Below are the results of questions 13-15 in Figures 15-17.

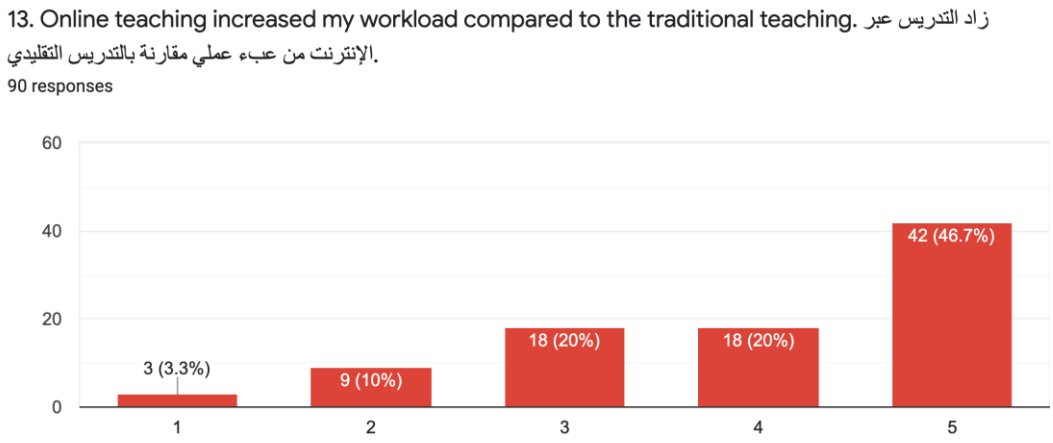

Figure 15: Question 13 of Teachers' Perceptions of Teaching Mathematics Online

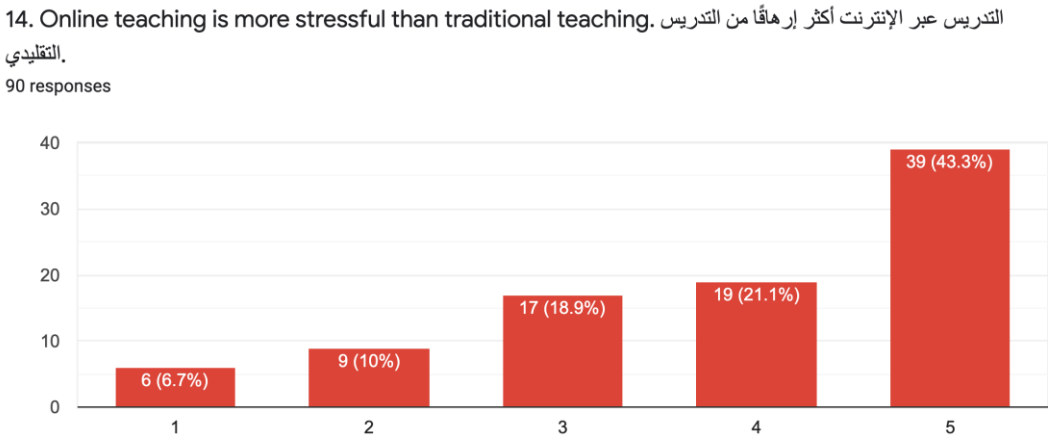

Figure 16: Question 14 of Teachers' Perceptions of Teaching Mathematics Online

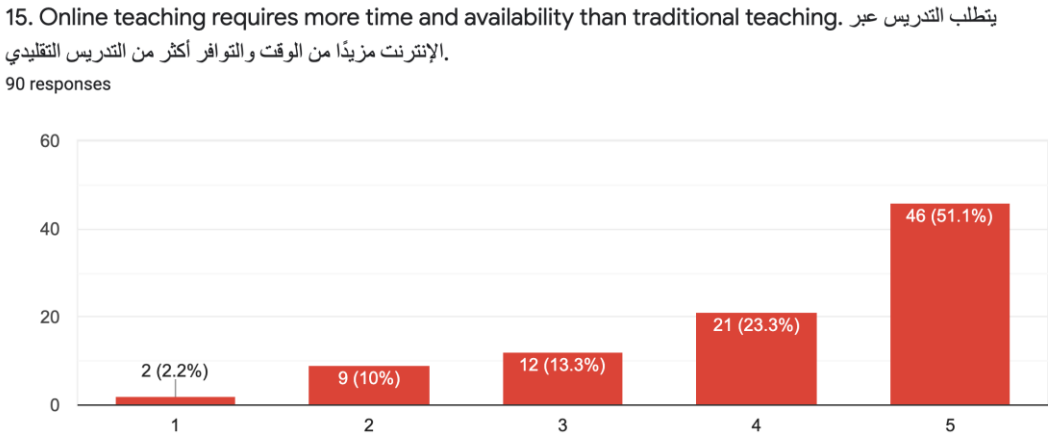

Figure 17: Question 15 of Teachers' Perceptions of Teaching Mathematics Online

The last three statements of question no. 1 are more related to the requirements and effects of online teaching in terms of the time, availability, and induced stress. According to the responses, most of the respondents agree (strongly agree + agree) that i) online teaching has increased their workload, ii) online teaching has increased their stress level, and iii) online teaching has increased the need for availability.

Whereas classroom requires teaching face to face and by usual method of instruction, online teaching requires much more effort, i.e., to convert all content into digital forms and to make use of different technologies and multiple channels according to the suitability of the topic. The additional amount of work and not being able to take direct feedback from the student which can be done comparatively easily in a face-to-face class is expected to induce stress. Moreover, in face-to-face class, the teachers are usually not expected to respond after the class hours, however in online classes, there is an additional expectation from the students and parents to be more available.

5.2.2 Part 2 Results: Obstacles of Teaching Mathematics Online

The other set of questions/statements that come under question 2 investigate the Obstacles that are encountered by the teachers when they teach mathematics to elementary students online.

Even though, the teachers perceived that online teaching is providing them with the opportunity to learn more digital mediums and use them for various purposes, the statement about impact of online teaching on student's achievements were not so positive. The reason behind those not so positive results can be understood in the following set of questions/statements and their responses.

Below is the result of question 1 in Figure 18.

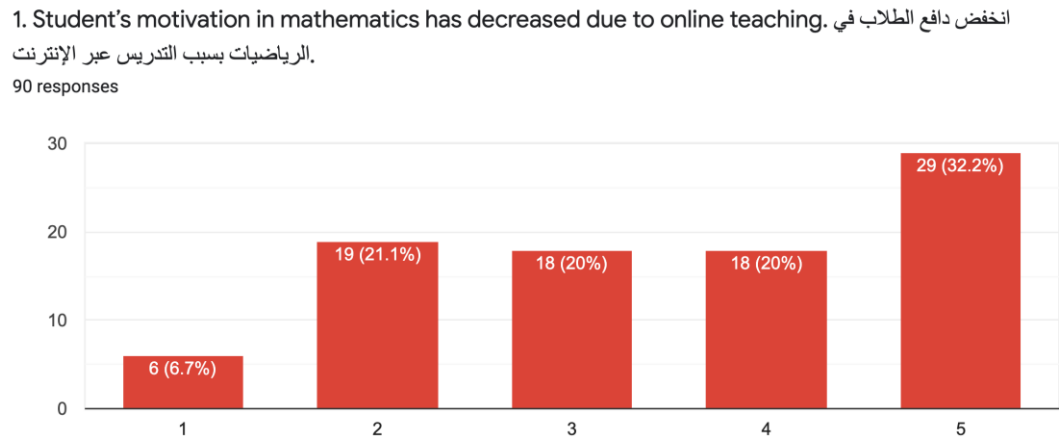

Figure 18: Question 1 in Obstacles of Teaching Mathematics Online

Most respondents agree that students' motivation has decreased due to online teaching of mathematics; however, a significant number of respondents also disagree with the notion. This variation of perception could be due to the absence of tools to gauge students' motivation particularly.

Below is the result of question 2 in Figure 19.

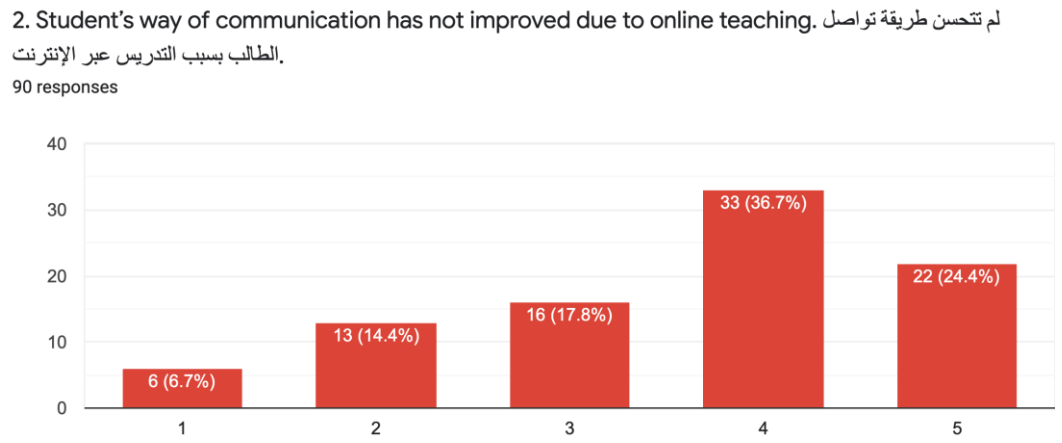

Figure 19: Question 2 in Obstacles of Teaching Mathematics Online

Most teachers agree that there has been no improvement in students' way of communication which is not surprising considering that students do not get to interact with each other directly as they otherwise do in face-to-face classes.

Below are the results of questions 3-4 in Figures 20-21.

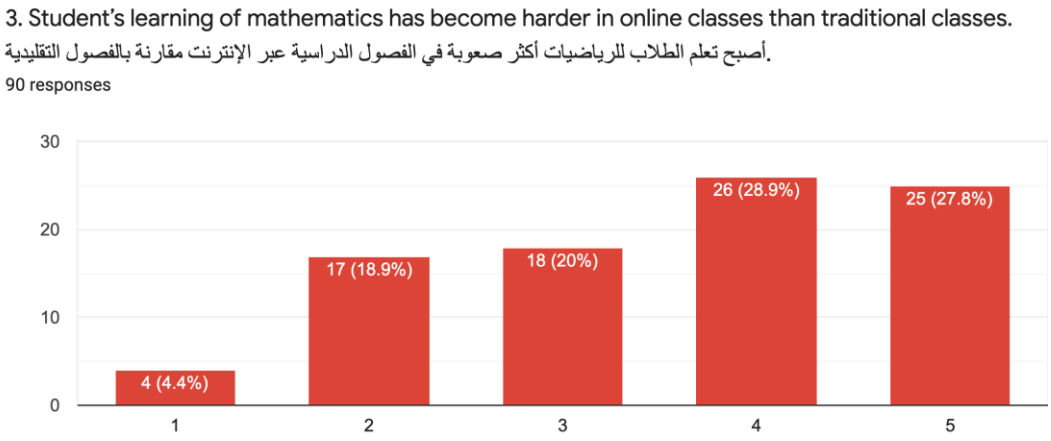

Figure 20: Question 3 in Obstacles of Teaching Mathematics Online

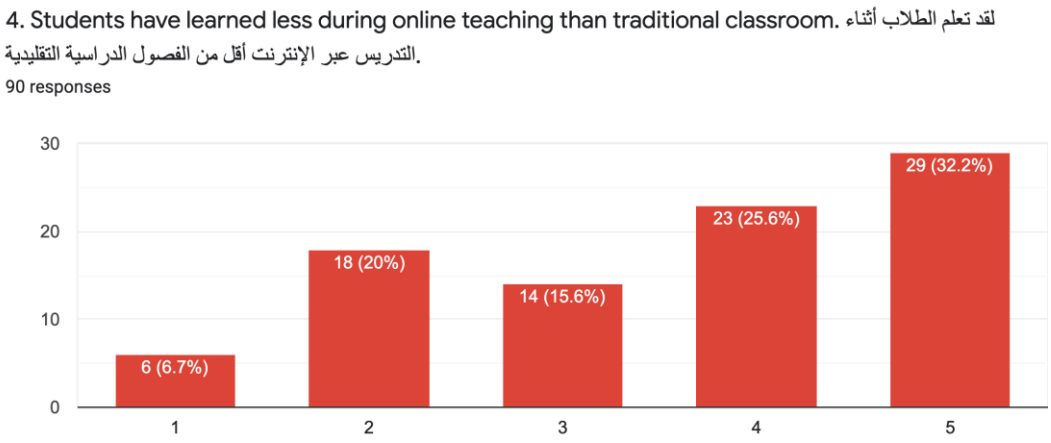

Figure 21: Question 4 in Obstacles of Teaching Mathematics Online

Most respondents agree that it has become hard for students to learn mathematics when taught online and the students have learned less in their online

sessions as compared to traditional classrooms. This seems like an explanation to the perception of the teachers around achievement of the students.

Below are the results of questions 5-7 in Figures 22-24.

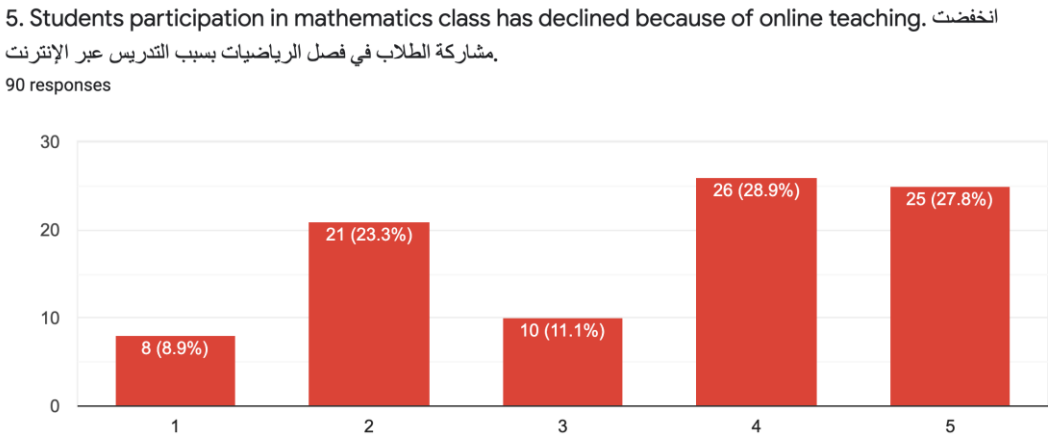

Figure 22: Question 5 in Obstacles of Teaching Mathematics Online

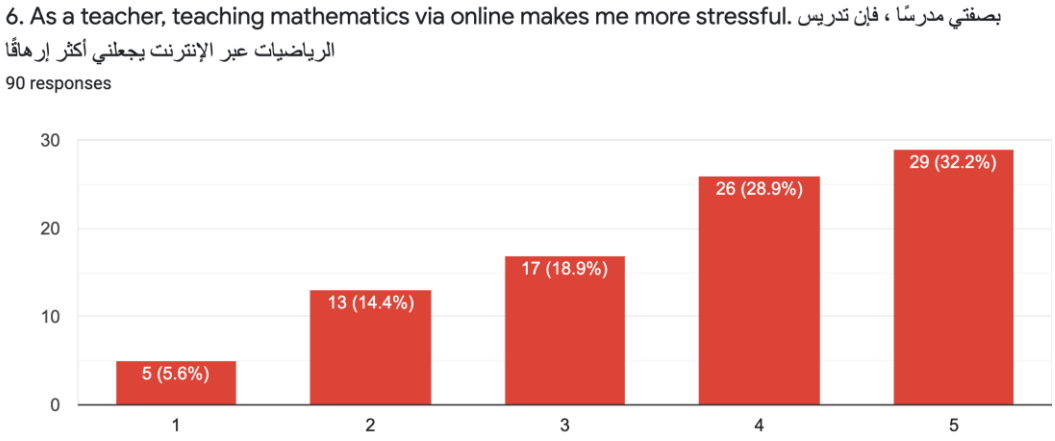

Figure 23: Question 6 in Obstacles of Teaching Mathematics Online

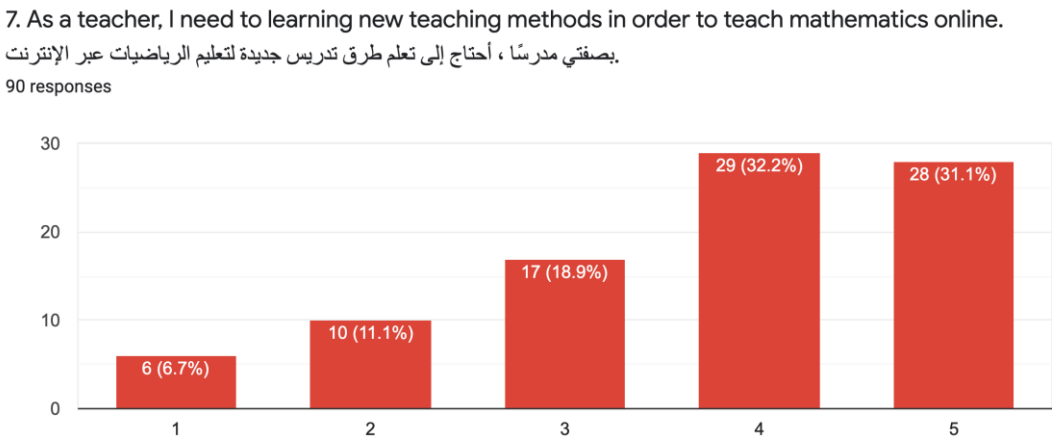

Figure 24: Question 7 in Obstacles of Teaching Mathematics Online

Even though the teachers are trained in teaching online, however the majority respondents still feel that there is a need for learning new methods so that the teachers can continue teaching online. This can lead to added stress which the majority teachers have also agreed to experiencing.

Below are the results of questions 8-10 in Figures 25-27.

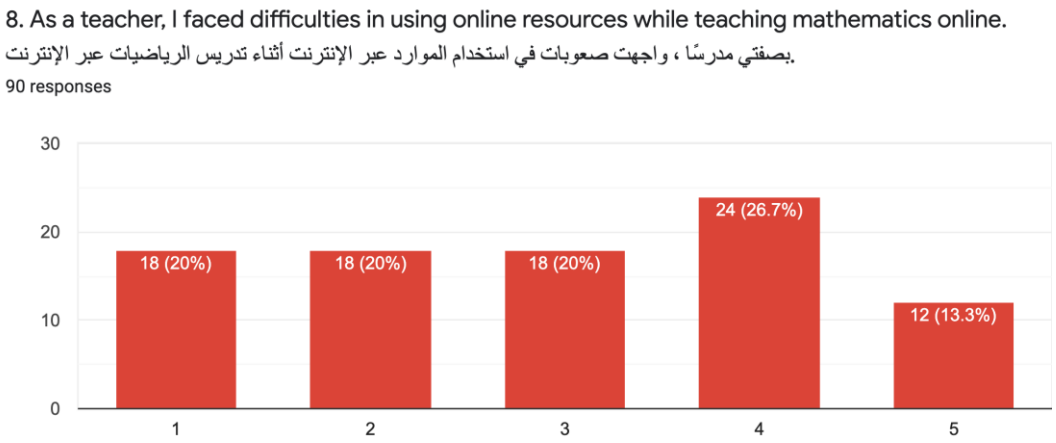

Figure 25: Question 8 in Obstacles of Teaching Mathematics Online

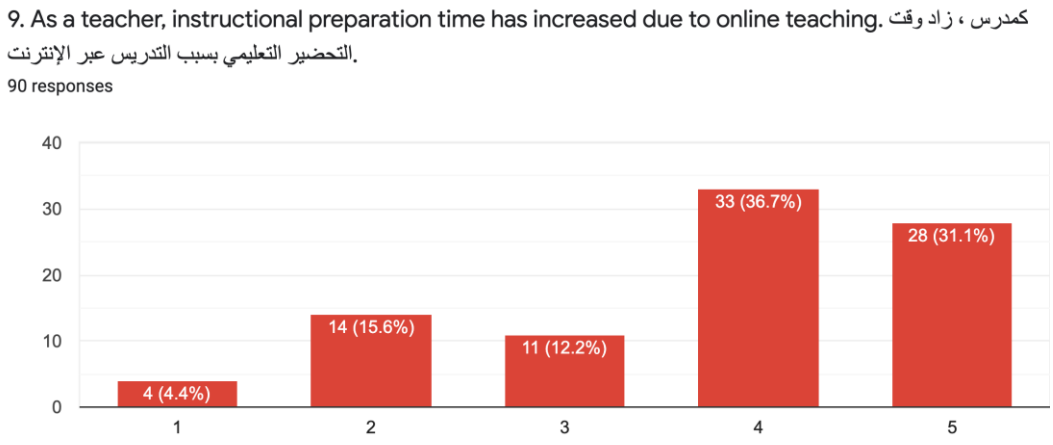

Figure 26: Question 9 in Obstacles of Teaching Mathematics Online

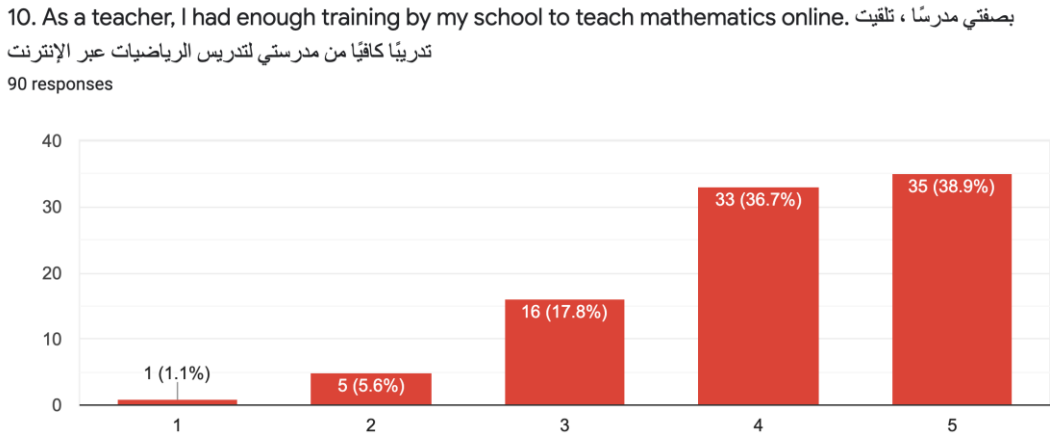

Figure 27: Question 10 in Obstacles of Teaching Mathematics Online

The responses to statement/question 8,9 and 10 reiterate the same results as were shown in the previous section regarding the perception of the teachers about online teaching of mathematics.

Below are the results of questions 11-13 in Figures 28-30.

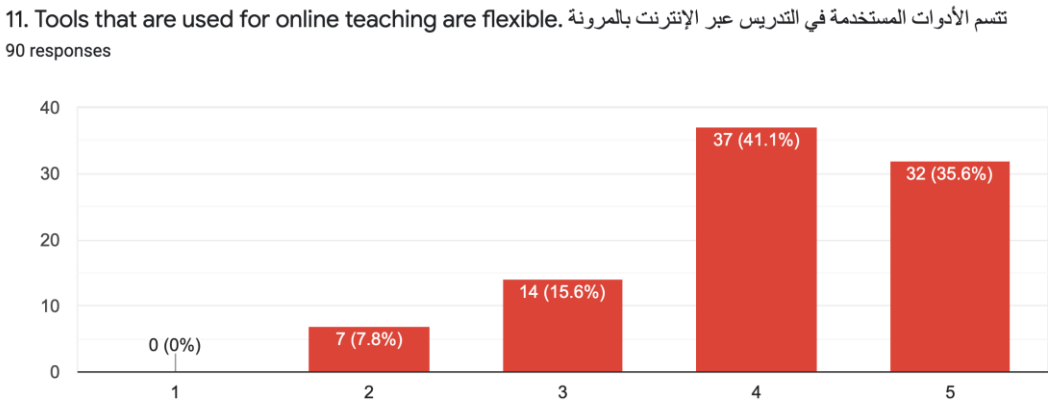

Figure 28: Question 11 in Obstacles of Teaching Mathematics Online

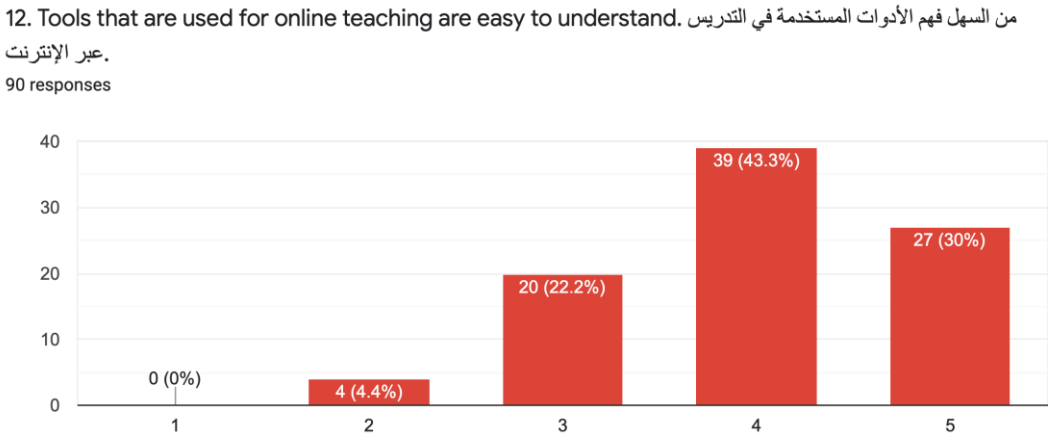

Figure 29: Question 12 in Obstacles of Teaching Mathematics Online

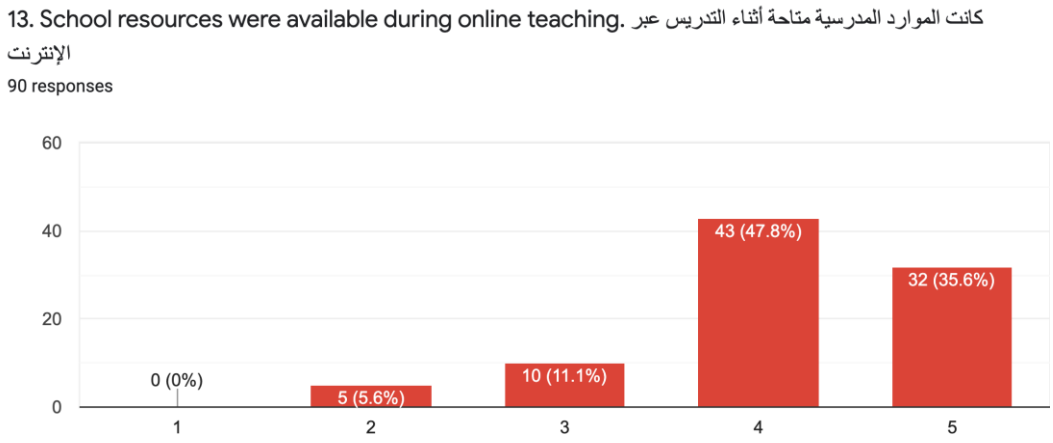

Figure 30: Question 13 in Obstacles of Teaching Mathematics Online

The responses to statement/questions 11, 12 and 13 reflects that most responders answered that school has provided the tools needed along with resources during online teaching.

5.2.3 Part 3 Results: Teacher's Preferences for Future

In response to the statements in part 3, even though teachers have received sufficient support and training from the school for teaching mathematics online, most of them would still prefer to teach face to face. It could be due to the obstacles faced especially from the students' side as they do not learn and communicate as much as they do in face-to-face classes.

Next page are the results of questions 1-3 in Figures 31-33.

1. If I have a choice, I prefer to teach mathematics face-to-face more than online. إذا كان لدي خيار ، فأنا أفضل تدريس الرياضيات وجهًا لوجه أكثر من التدريس عبر الإنترنت

90 responses

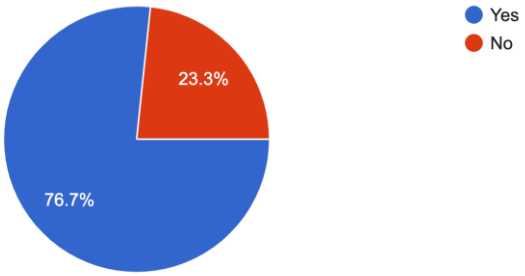

Figure 31: Question 1 in Teacher's Preferences for Future

2. School administration provided me with needed support during online teaching. زودتني إدارة المدرسة بالدعم المطلوب أثناء التدريس عبر الإنترنت

90 responses

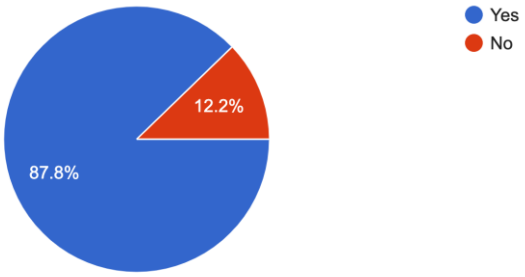

Figure 32: Question 2 in Teacher's Preferences for Future

3. School administration provided me with the needed training to teach online. زودتني إدارة المدرسة بالتدريب اللازم للتدريس عبر الإنترنت.

90 responses

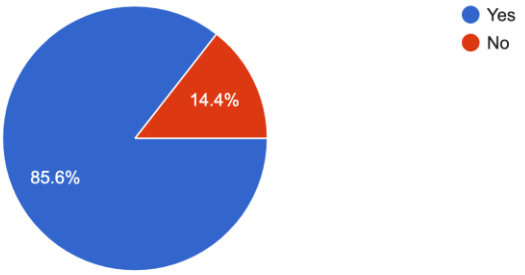

Figure 33: Question 3 in Teacher's Preferences for Future

5.3 Discussion of the Results in Relation to the Literature

According to the literature, the perception held by the teachers towards computer technology is one of the major factors that influence the use of technology (Liu et al., 2020). The attitudes were classified into three dimensions, i.e., “Active”, “Behavioral” and “Cognitive” (Maio al., 2018). On the other hand, the conditioning factors are classified into the categories of “knowledge”, “Skills” and “Attitude” (Spiteri & Chang Rundgren, 2018). However, the way teachers perceive the support; drives the integration of pedagogical resources of ICT. For improving the perception regarding technology, the most influential model for motivation is Self-determination and in this sense the support and digital self-efficacy perceived and provided by the educational institute can improve the teachers’ motivation and commitment for designing innovative material. Provision of training to teachers is another major factor that can affect the perception with regards to incorporation of technology and digital mediums into teaching mathematics and other subjects (Sánchez-Prieto et al., 2019).

The whole idea about perception of the teachers and their effectiveness in online teaching as mentioned in the literature can also be seen reflected in the survey responses. The survey respondents in this case have been provided with adequate training, teaching material and administration support, which is why, the majority of teachers hold a positive perception about teaching mathematics online as depicted in the responses to statement 1-7 (under research question 1).

The literature suggests that using technology has the potential of disrupting education, especially in the case of mathematics and it is a serious concern with regards to disengagement of the students according to Moldavan et al. (2021). The results from the survey in the present study also show a number of obstacles faced by the students in learning mathematics online, as perceived by the teachers. Even though the study

has not been conducted on the students, however the respondents, i.e., teachers still believe that the students lack communication, and it is harder for them to learn mathematics online.

The literature also highlights that computer skills of a prospective teacher are also important for their effectiveness and productivity. Tekinarslan (2008) puts emphasis on the idea that it is important for the teachers to be equipped with the adequate knowledge, however a majority of researchers agree that the technology should only be used as a tool and not the goal of the education (Usta & Korkmaz, 2010). When a software or app is selected by a teacher, it is important to endure that the software or app is easy to be used by the children especially considering certain aspects such as the app or software to have features such as step by step teaching, execution of exercises, interaction, and collection of feedback (Zipke et al., 2019).

It is safe to say that the responses of the present study iterate the same idea. As the literature suggests that knowledge of computers is important at the teacher's end, so is the case in this study, i.e., teachers have computer knowledge. However, despite the knowledge of the teachers, the students are still struggling in their learning from online teaching. One of the reasons behind this struggle could be the same as mentioned in the literature, i.e., the appropriateness of the software or app in terms of use by the students. It is quite possible that the students in case, are struggling because they find the technology difficult to use for learning as well as assessments.

There are other studies that does not necessarily focus on teaching mathematics remotely, but they focus on use of mobile technologies and collaborative learning by using online mediums within the classroom for teaching mathematics. The results of those studies can also be compared to the results of the present study to have a better understanding of how these results reflect similar or different findings in terms of

teaching mathematics online whether remotely, in classrooms or by using different mediums such as mobiles.

A study by Alqallaf (2016) examined perception of elementary school teachers in Kuwait about their ability with regards to integration of Mobile learning in their practices including the major barriers that hinder the ability of teachers in creating an environment of mobile learning.

The study by Alqallaf (2016) also sought to identify and comprehend the perception of teachers about whether they were able to create a collaborative learning environment with cloud computing which tallies with the skills of the 21st century and may also explain the readiness of the teachers for future education reforms in Kuwait. For this purpose, the elementary level mathematics teachers were asked to provide a description of the reasons for integration of mobile technology and the barriers according to them.

As a result of their survey, 90% of the participants agreed that use of mobile technology was an effective tool for delivering mathematical concepts. In contrast to this finding, the finding in current study suggests that almost 75% of the participants agree that the tools used for online teaching are flexible.

A majority of the participants in Alqallaf's (2016) study show readiness for using mobile technology for teaching mathematics. In contrast, the 76.7% respondents in current study affirmed that if provided with a choice, they will prefer to teach mathematics face-to-face.

On the other hand, the results from a study by Bringula et al. (2021) show that 43% of learners believed that they will fail in mathematics if they continue online learning which means a majority agreed that face to face teaching of mathematics is more effective.

According to current study, 56% of participant teachers believed students' mathematic learning in online classes has become harder than traditional classes, 58% believe that students have learned less in online classes and 56% believe that students' online participation has decreased in online classes. The study by (Bringula et al., 2021) provides a list of challenges faced by the learners in online mathematic classes which may provide support for the responses from the teachers who believe that student's participation and learning has decreased.

The list of challenges as mentioned in Bringula et al. (2021) include "Technological" (power and internet interruptions), "Personal" (lack of focus, less productivity and procrastination), "Pedagogical" (difficulty in understanding of topics", "Domestic" (household chores, running errands, noise & other distractions, uncontrolled situations, lack of family support) and some others.

According to findings from Ã–zdemir (2018) study on perception of prospective math teachers about using technology is teaching mathematics, 93.7% of the prospective elementary math teachers expressed a positive opinion for necessity of the use of internet which is also consistent with the overall findings of the present study about the importance of using internet. However, the use of internet is not limited to online classes but includes using internet for help from various learning sources outside the classrooms and learning hours.

5.4 Recommendation and Suggestions for Further Research

From the responses of present study, it is prominent that there are several obstacles to teach mathematics online, especially when it comes to maintain students' motivation and interest as well as ensuring that they have learned the concepts. Since online teaching is becoming the norm after the COVID-19, it is important to

investigate online teaching further by listening to students voices and examining their overall achievement and preferences.

Another area for further research is the type and number of digital mediums and formats being used for the purpose of teaching mathematics online. Using different mediums and formats of shared files etc. can be confusing for students, especially students in elementary or smaller levels. It may also add to distraction and hence impact their interest and understanding negatively. There is room for research to understand which mediums are the best and what should be the suitable number of maximum mediums used within a math lesson.

Even though the teachers in this study particularly were properly trained to conduct online classes but there is need for more research in terms of professional development of the teachers including their training to use digital mediums, and to ensure that the students are interested throughout and how to take regular feedback from the students (Bakker et al., 2021). Another recommended area for research is the assessments. It is important to understand whether there is a need to change the format of assessments taken through online mediums (Bakker et al., 2021).

5.5 Limitation of the Study

Some of the limitations to this study are:

- The survey responses have been collected from a small sample, i.e., 90. It is possible that results could have been different if the number of participants were higher.
- The survey responses are limited in scope as the respondents had ample support, necessary resources, and training for teaching mathematics online. The

scenario however would be different for teachers who lack the required support, resources, and training.

- The study has been conducted at a time when online classes are compulsory and not a choice due to the corona virus lockdown, hence could have different implications when given a choice or combined with face-to-face setting in a more hybrid system.

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Appendices

Appendix 1 - Questionnaire

Teachers' perceptions of teaching mathematics online in Elementary Schools This questionnaire is intended to collect your perceptions of teaching mathematics online. Your participation in this questionnaire is completely voluntary. The researcher highly appreciates your cooperation for taking the time and effort to answer this questionnaire.

Years of Experience	less than 5	5 - 10	11 - 20	More than 20
Educational level	Bachelor's	Master's	Doctorate	Other
Your Gender		Male	Female	

Part One: Demographic information

Instructions: Please tick (✔) the box that best represents your view. Strongly Agree (5); Agree (4); Neutral (3); Disagree (2); Strongly Disagree (1).

No.	Teachers' Perceptions of Teaching Mathematics Online in Elementary Schools	SA (5)	A (4)	N (3)	D (2)	SD (1)
1.	I'm able to use different digital technologies.	5	4	3	2	1
2.	I'm able to adapt my lessons to improve student learnings.	5	4	3	2	1
3.	I'm able to use digital technologies to represent mathematical ideas.	5	4	3	2	1
4.	I'm able to use digital technologies to solve mathematics questions.	5	4	3	2	1
5.	I'm able to use technology to support students' learning for the lesson	5	4	3	2	1

No.	Teachers' Perceptions of Teaching Mathematics Online in Elementary Schools	SA (5)	A (4)	N (3)	D (2)	SD (1)
6.	I can use strategies that combine mathematical content, digital technologies and teaching approaches to support students' understandings as they are learning mathematics.	5	4	3	2	1
7.	Teachers are more effective as a teacher in the classroom than online.	5	4	3	2	1
8.	Online teaching has a positive effect over student's achievements.	5	4	3	2	1
9.	Online teaching has increased my experience with being expert with technologies.	5	4	3	2	1
10	Online teaching gave me as teacher the chance to use different methods of teaching mathematics than before.	5	4	3	2	1
11	Online teaching is more suitable way to teach mathematics for elementary students.	5	4	3	2	1
12	Online teaching made me more confidence in teaching mathematics than before.	5	4	3	2	1
13	Online teaching increased my workload compared to the traditional teaching.	5	4	3	2	1
14	Online teaching is more stressful than traditional teaching.	5	4	3	2	1
15	Online teaching requires more time and availability than traditional teaching.	5	4	3	2	1

Part Two: Obstacles of teaching mathematics online

No.	Obstacles of Teaching Mathematics Online	SA (5)	A (4)	N (3)	D (2)	SD (1)
1.	Student's motivation has decreased due to online teaching.	5	4	3	2	1
2.	Student's way of communication has not improved due to online teaching.	5	4	3	2	1
3.	Student's learning methodologies become harder than before.	5	4	3	2	1
4.	Students have lost and learned less during online teaching than before.	5	4	3	2	1
5.	Students participation declined because of online teaching.	5	4	3	2	1
6.	As a teacher I felt stress and the need to learn a lot in order to deliver any teaching methods.	5	4	3	2	1
7.	As a teacher, I faced difficulties while using online resources in order to teach online.	5	4	3	2	1
8.	As a teacher, instructional preparation time has increased and require more time due to online teaching.	5	4	3	2	1
9.	Tools that are used for online teaching are flexible and easy to understand.	5	4	3	2	1
10.	School resources were enough and training were supported as needed.	5	4	3	2	1

Part 3: Teachers' Preference for Future

If I have a choice, I prefer to teach mathematics face-to-face more than online	Yes	No
School administration provided me with needed support during online teaching	Yes	No
School administration provided me with the needed training to teach online.	Yes	No
I enjoy teaching mathematics online	Yes	No

Appendix 2 - To Whom It May concern

UAEU كلية التربية College of Education

جامعة الإمارات العربية المتحدة United Arab Emirates University

Date: 11-03-2021

To Whom It May Concern

This is to confirm that **Kamar Fayez (ID: 201870032)** currently a Master student at the College of Education- Major **Curriculums & Instructions in Mathematic** , at United Arab Emirates University .She is conducting a study for her final course on:

Teachers' perceptions of teaching mathematics online in Elementary Schools

We kindly ask for permission to allow **Kamar** to start her questionnaire at your school.

Respectfully,

Ali Shehadeh

Prof. Ali Shehadeh

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Appendix 3 - Approval Letter

UAEU Faculty of Humanities and Social Sciences

جامعة الإمارات العربية المتحدة
United Arab Emirates University

Social Sciences Ethics Sub-Committee
Approval Letter

June6 st 2021

This is to certify that research proposal N: *ERS_2021_*7295, titled: *Teachers' perceptions of teaching mathematics online in Elementary Schools,* submitted by *Kamar Kamar* has been reviewed and approved by the UAEU subcommittee for research ethics in social sciences.

Sincerely

Professor Hamza Dodeen
Chair of the UAEU Research Ethics Sub-Committee for Social Sciences
Department of Cognitive Sciences
United Arab Emirates University
Email: hdodeen@uaeu.ac.ae

Appendix 4 - Informed Consent Form for Participant

TITLE OF THE STUDY: Teachers' Perception of Teaching Mathematics Online in Elementary Schools-Al Ain

Researcher: Kamar Fayez

Social Sciences Research Ethics Committee
- Consent to Participate in a Research Study-
Please read carefully before signing the Consent Form!

Teachers' perceptions of teaching mathematics online in Elementary Schools in Al Ain

You will be asked to provide or deny consent after reading this form.

Topic of the research, the researcher(s) and the location

You have been invited to take part in a study to investigate teacher's views of teaching mathematics online for elementary students.

This study will be conducted by Kamar Fayez in al Ain schools for Mathematics teachers.

The study will take place at different schools located at al ain.

Participation in this study will take half an hour 5 minutes for personal information and 25 minutes to answer the questions for the survey.

Benefit of the research

There are multiple benefits for the participant as the results will help endure and enhance the method of online teaching specifically for mathematics teachers.

Procedure/setting

Description of the procedure

The questionnaire will be an online questionnaire and the setting will be anywhere.

Safety Information

There will not be any potential risk for the participants.

Confidentiality and Privacy Information

This is a conformation that your personal information will be revealed and will be protected. As a participant you will not be asked to give your name neither your contact address.

Right to Withdraw

As a participant, you have the right to withdraw from the questionnaire at any time you want in any stage in the process without being penalized.

1. I confirm that I have read and understood the above information sheet and have had the opportunity to ask questions.
2. I understand that my participation is voluntary and that I am free to withdraw.
3. I understand that my data will be kept confidential and if published, the data will not be identifiable as mine.

I agree to take part in this study:

_____ _____

(Name and signature of participant) (Date)

(Name and signature of person taking consent)	(Date)
(Name and signature of witness (if participant unable to read/write)	(Date)
(Name and signature of parent/guardian/next of kin (when participant unable to give consent due to age or incapacity)	(Date)