The impact of using self-learning platforms on students' performance and motivating them to learn mathematics in Cycle/3 schools in the Emirate of Abu Dhabi.

أثر استخدام منصات التعلم الذاتي على أداء الطلاب وتحفيزهم على تعلم الرياضيات في مدارس الحلقة / 3 في إمارة أبو ظبي.

by

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ABSTRACT

The United Arab Emirates has worked for several years to consolidate the concept of self-learning among school students. The Ministry of Education (MOE) and the Emirates Schools Establishment (ESE) have provided schools with educational platforms based on artificial intelligence, giving students a greater opportunity for self-learning and making them more self-reliant. Alef Education platform started working in government schools in 2016 and is now considered the most important educational platform in schools because of the support it provides to students to develop their performance. This mixed study aims to identify the impact of self-learning platforms on students' performance and motivation towards learning mathematics in cycle/3 schools in the Emirate of Abu Dhabi. The study targeted 1042 students of both sexes from the Grade/10 and Grade/12 in its advanced and general streams belonging to four secondary schools in the Emirate of Abu Dhabi and 40 mathematics teachers from the same schools. 285 students and 19 teachers responded.

The current study revealed the important role of using self-learning platforms in improving students' performance in mathematics and motivating them to learn it. Analysis of students' responses indicated a relatively large influence of the role of self-learning; That is 79.8%. The impact of using these platforms varies with the level of students. Teacher and student responses were significantly correlated. Educators suggested updating the existing platforms to more interactive platforms with simpler and gradual curricula that are compatible with all levels of students and various assessment tools to improve student performance and motivation in mathematics, in addition to using only one platform to avoid student distraction.

This study will provide an opportunity for education decision-makers in the United Arab Emirates to develop a system of self-learning platforms to become more sophisticated and effective in improving students' learning opportunities in the future. On the other hand, this study opened the door for future researchers to expand the scope of research on these platforms to include other subjects such as languages and sciences.

الملخص

لقد عملت دولة الإمارات العربية المتحدة منذ عدة سنوات على ترسيخ مفهوم التعلم الذاتي لدى طلبة المدارس. فقد قامت وزارة التربية والتعليم ومؤسسة الإمارات للتعليم المدرسي بتزويد المدارس بمنصات تعليمية تعتمد على الذكاء الاصطناعي وتعطي الطلبة فرصة أكبر للتعلم ذاتيا وتجعله أكثر اعتمادا على نفسه. منصة ألف للتعليم بدأت العمل في مدارس الدولة منذ العام ٢٠١٦ وتعتبر الان أهم منصة تعليمية في المدارس لما تقدمه من دعم للطلبة لتطوير أدائهم. تهدف هذه الدراسة المختلطة إلى التعرف على أثر منصات التعلم الذاتي على أداء الطلبة ودافعيتهم نحو تعلم الرياضيات في مدارس الحلقة الثالثة في إمارة أبو ظبي. استهدفت الدراسة ١٠٤٢ طالبا من الجنسين من طلبة الصفين العاشر والثاني عشر بفرعيه المتقدم والعام ينتمون لأربعة مدارس ثانوية في إمارة أبو ظبي و ٤٠ معلما للرياضيات من نفس المدارس وقد استجاب منهم ٢٨٥ طالبا و١٩ معلماً .

كشفت الدراسة الحالية عن الدور المهم لاستخدام منصات التعلم الذاتي في تحسين أداء الطلاب في الرياضيات وتحفيزهم على تعلمها. أشار تحليل استجابات الطلاب إلى وجود تأثير كبير نسبيًا لدور التعلم الذاتي ؛ أي 79.8٪. يتغير تأثير استخدام هذه الأنظمة الأساسية مع تغير مستوى الطلاب. ارتبطت ردود المعلمين والطلاب بشكل كبير. اقترح المعلمون تحديث الأنظمة الأساسية الحالية إلى منصات أكثر تفاعلية بمناهج أبسط وتدريجية تتوافق مع جميع مستويات الطلاب وأدوات تقييم متنوعة لتحسين أداء الطلاب وتحفيزهم في الرياضيات ، بالإضافة إلى استخدام نظام أساسي واحد فقط لتجنب إلهاء الطلاب.

ستتيح هذه الدراسة الفرصة لأصحاب القرار عن التعليم في دولة الامارات العربية المتحدة بتطوير منظومة منصات التعلم الذاتي لتصبح أكثر تطورا وفعالية في تحسين فرص تعلم الطلبة مستقبلا. من جهة أخرى فإن هذه الدراسة فتحت الباب أمام الباحثين مستقبلا في توسيع نطاق البحث حول هذه المنصات ليشمل مواد دراسية أخرى مثل اللغات والعلوم.

DEDICATION

This dissertation work is dedicated to my wife, Sumaya, who has been a constant source of support and encouragement during the challenges of the research and life. I am truly thankful for having you in my life. This work is also dedicated to my father soul, who have taught me to work hard for the things that I aspire to achieve.

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Table of Contents

List of tables

List of Appendices

CHAPTER 1: Introduction

1.1 Background

Education has been and still is one of the top priorities of the UAE government. Achieving a highly efficient education system by 2021 has been one of the six priorities that the country has set since 2010 within the UAE Vision 2021. Since that time, the Ministry of Education in the UAE began searching for the best educational practices that would help achieve this vision. Developing the students' self-learning system and transforming education from teacher-centered learning to student-centered learning was the starting point to achieve this vision as it allows students to have a positive interaction with the teacher by setting up direct educational activities that allow them to express their opinions and suggestions (Freire 2018). For that, it was necessary to provide the appropriate environment by providing appropriate technological resources based on artificial intelligence techniques that facilitate the learning process and teaching design (Colchester et al. 2017). Educational platforms have become a reality in the educational process considering the expansion of the use of technology and the internet. For the educational platform to be useful, it must have some important features such as creating court, tests, standard courses, managing educational documents, managing cooperative workspace for learners and/or teachers, to monitor the learner's learning and evaluation, managing the learner's education, and providing work tools for the learner (download tools, editors ..etc.). Availability of various communication tools and procedures for their management (chat, videoconferencing. etc.) (Ouadoud, Rida & Chafiq 2021). Moreover, Educational platforms provide the opportunity for learners to store and reuse information, also it's developed students' 21st century skills and increase their opportunity for self-learning to make learning more interesting for students Singh, Thakur & Nagaraju 2019)

Since 2016, the Ministry of Education in the UAE began accrediting the use of the Alef platform within the country's schools, until now it has been used in 456 schools (339 public schools and 117 private schools). The use of the platform has expanded over the past few years, as it is now present in three countries of the UAE, USA, and Canada. The following table shows how quickly the use of the platform has spread since 2016 until now (alef education 2022).

Table 1. The numbers of participants in the program, including schools, students and teachers and leaders in USA, UAE and Canada (alef education 2022).

Year	16/17	17/18	18/19	19/20	20/21	21/22
Schools	1	2	63	206	418	4000
Students	8	1000	25,378	60,426	121,000	670,000
Teachers & Leaders	8	68	1,887	4747	10,080	40,000

The Alef education platform is not the only platform that supports self-learning in schools affiliated with the Ministry of Education, but it is the only platform that provides an educational curriculum that covers all educational outputs approved by the Ministry of Education Alyammahi (2020). At the same time, it provides the necessary support through technicians and education specialists inside schools for teachers and students. Therefore, all schools depended on this platform as a main and essential tool for education. Furthermore, the ALEF platform is based on providing all educational resources necessary for students to understand the content on their own. Each lesson begins with an introduction that includes the topic's main idea, which is often conveyed through a short video or written text. The student then progresses to the second stage, where the scientific material is clarified in a variety of ways and the student has the ability to repeat the existing digital content multiple times. Following that, the student's level of understanding of the scientific content he studied is assessed by completing a series of exercises of varying difficulty. In the event of failure on the first attempt, the system also allows the student to re-evaluate himself multiple times. The student must complete the exit ticket at the end of the lesson, which contains a

variety of problems to ensure that he has a thorough understanding of the material. An important question arises at this point: what role does the teacher play in all of this? The platform allowed the teacher to control the start and end of lessons, as well as add some extra activities for the students. He could also use the Alef game to add a gamification element to the lesson. The ability to monitor students' performance and progress during class through his dashboard on the platform, which allows him to provide appropriate feedback to students and parents, is perhaps the most important point.

1.2 Statement of the Problem

Independent self-learning is based on the learner discovering his needs and then making plans for the learning process and following up the impact through monitoring the results and evaluating the process by the learner independently (Dubosas 2017). But when looking at the existing reality, the adoption of independent self-learning is a difficult matter at the secondary level, so the Ministry of Education has tended to rely on self-learning related to teacher support for students through guidance and follow-up according to students' needs and abilities. This is what the Alef platform provides for education, where the role of the teacher is limited to opening lessons, following up on students' performance and progress, and rewarding students through badges. The question remains, to what extent can the students of cycle/3 schools in the emirate of Abu Dhabi learn on their own through these platforms, and whether these platforms increase students' motivation towards learning, in addition to the extent of their impact on students' achievements in mathematics. Through this mixed study, the researcher seeks to answer these questions and present some recommendations and proposals that will enhance self-learning among students in the future and make it easier for school leaders and stakeholders to follow up on the implementation of this type of learning, which has become a fait accompli in all state schools.

1.3 Objective of the study

Perhaps enabling students to learn on their own requires many requirements and more effort, as changing the previously prevailing style of education which is traditional education to a new educational style that depends on the student himself, in which the role of the teacher is limited to guidance and facilitation of the student learning process needs to provide educational platforms that depend on Artificial intelligence and supports learning with 21st century skills, makes students more capable of critical thinking and problem solving. Also, improves their performance level and increases their motivation towards learning.

It has now been more than five years since the inclusion of the Alef platform for education within government schools in UAE as a self-learning platform for students. The most important question is, have these platforms played their role in raising students' levels and motivating them to learn mathematics? So far, there are no specific researches in this field, and this is what gives this research more important to reach results and recommendations that would support school leaders and teachers to develop a self-learning system through educational platforms.

This study aims to determine the impact of self-learning through platforms on students' performance and increase their motivation towards learning in mathematics among students of the cycle/3 schools affiliated with the Emirates Schools Establishment (ESE) in the Emirate of Abu Dhabi, from the point of view of students and teachers.

1.4 Research Questions

Through this mixed research study, the researcher will attempt to answer the following research questions:

(1) To what extent does the usage of self-learning platforms affect the performance of cycle/3 school students in mathematics in the Emirate of Abu Dhabi?

(2) To what extent does the usage of self-learning platforms affect students' motivation to learn mathematics in Cycle/3 schools in the Emirate of Abu Dhabi?

1.5 Study organization

This study consists of six chapters. The first chapter is the "Introduction", which contains a summary of the subject of the study, the problem of the study, the purpose of this study, research questions and the organization of the study. The second chapter is "Literature Review", which included the theoretical framework of the study, the concept of self-learning and the most important teaching strategies that support self-learning through previous studies and the impact of feedback on students' self-learning in addition to learning motivation and focus on some global self-learning platforms. The third chapter is "Methodology", which included the study context, sampling method, research method, and data collection methods. The fourth chapter is " Data Analysis & Findings ", which presents the results of the study by analyzing the results of the questionnaires using the SPSS system to answer the study's questions . The fifth chapter is "Discussion" where the researcher presents a comparison of the results of his study with the most important results obtained in previous studies to show the extent of compatibility or difference between them. The sixth chapter is "Conclusion", which summarizes the impact of the use of self-learning platforms on students' performance and motivation towards learning mathematics, in addition to some recommendations and suggestions related to the use of platforms that support self-learning and presenting the most important limitations of the current study.

CHAPTER 2: Literature Review

2.1 Self-learning

The advent of e-learning platforms marks the start of a shift in e-learning settings to make them more successful for both learners and teachers. It aids in the creation of collaborative e-learning environments and encourages collaboration and sharing. It also allows students to communicate with their peers, take part in successful learning experiences, create effective learning experiences, and share content with their peers (Kaplan & Haenlein 2010). Learner behavior and responses to stimuli during the learning process are the subject of behavioral theory. behaviourist learning theory suggests that "learning is a change in observable behaviour caused by external stimuli in the environment" (Anderson 2008, p.18). Thus, the focus is on what can be observed in the learner's behavior during the learning process (Picciano 2021). On the other hand, the learning process depends on the presence of the learner, the teacher, and the problem in the same area in search of a solution and this makes it crucial to the learning process (Picciano 2021). In order to provide basic assistance to the learners and facilitate the learning process, the teacher must play a vital role in the self-learning process, and this is what educational platforms provide for self-learning in terms of providing specific roles for the teacher and the learner.

Perhaps the shift from teacher-centred education to student-centred education is a basic requirement of the Ministry of Education (MOE) and the Emirates Schools Establishment (ESE) to advance the level of education in the United Arab Emirates and include 21st-century skills in student learning. A student-centred approach to learning creates a challenge to students' knowledge and increases their ability to choose learning activities and assessments (Freire 2018). The transition to the stage of self-learning and the independence of education would make the student the focus of the educational process, with the need to preserve the role of the teacher as a facilitator of the educational process through monitoring, evaluation and providing feedback to students on their performance. Through his systematic review of the literature, Meyer

et al. (2008) confirmed that independent learning includes self-learning by students on their own, as well as self-learning in which the teacher plays the role of facilitator. Meyer et al. (2008) added that there are several benefits associated with independent learning, such as increasing the motivation towards learning, increasing achievement, and enhancing social bonding with others. Through a study he conducted on students at the Christian University of Indonesia, Naibaho (2019) recommended that the independent learning strategy be included in the student learning process because of its clear impact on improving the students' speaking level.

With the availability of four elements in a networked human and IT environment, the process of self-learning becomes easier and more effective: the learner's awareness of what is required of him during the learning process and his possession of the necessary knowledge and skills, the learner's control of self-organization during the learning process in terms of his ability to distribute effort and determine the appropriate strategy for learning, the availability of good motivation for the learner to ensure the continuity of learning, and finally the availability of a context based on the interrelationship between the human environment represented by parents, peers, teachers and the IT environment that provides ease of transmission of information and speed of access to the learner (Mok & Cheng 2001).

2.2 Self-efficacy and self-regulation

To achieve effective self-learning, two important things must be available to the learner, self-efficacy, and self-regulation. The learner's self-efficacy enhances his ability to complete tasks better and improve learning outcomes by making certain learner characteristics available, such as the ability to use technology, set learning goals, choose an appropriate solution strategy, and manage time. Improve learning outcomes by making certain learner characteristics available, such as the ability to use technology, set learning goals, choose an appropriate solution strategy, and manage time. Following the same path, the teacher plays an important role in building the self-efficacy of his students (Toharudin, Rahmat & Kurniawan 2019). Most of the time,

students must make critical decisions during their learning process, such as determining the best solution strategy, the best time to implement it, and the distribution of roles among them. Likewise, during the self-learning process, students need to make appropriate decisions that enable them to learn properly, which is provided by students' self-efficacy (Zheng et al. 2018). AlDahdouh (2018) defined self-efficacy as the ability of a person to achieve set goals through careful understanding and implementation of actions. Having a high level of self-efficacy enables students to raise the level of their achievement and their ability to carry out tasks. While having low levels of self-efficacy would reduce learners' ability to solve problems and raise the level of performance (Feldman & Kubota 2015; Kumar & Daniel 2016). According to the preceding, the student's high self-efficacy is a prerequisite for the success of the self-learning process, which requires facilitating it for the student through available educational platforms and ongoing support from teachers. Anxiety is one factor that can affect students' self-efficacy; Rozgonjuk et al. (2020) discovered that reducing students' anxiety levels improves their math self-efficacy. Gao (2020) confirmed that girls experience more anxiety and social persuasion when learning mathematics than boys. According to Yildiz & zdemir (2019), there is a direct correlation between students' mathematical achievement and their experiences with various sources of self-efficacy. Perhaps the recent shift of education to online learning has reinforced the need for students' self-regulation considering the reduced role of the teacher in directing and interacting with students. Self-regulation is the "self-generated thoughts, feeling, and actions that planned and cyclically adapted to the attainment of personal goals" (Boekaerts, Zeidner & Pintrich 1999, p.13). Among the most important features that make a student self-regulated are the variety of learning tactics used, self-sufficiency, and commitment to achieving the defined goals (Schunk & Zimmerman 1997). Self-regulation plays an essential role in the effective learning process through its direct impact on learning processes and outcomes (Järvelä, Hurme & Järvenoja 2011; Järvelä & Hadwin, 2013; Panadero, Klug & Järvelä 2016; Trevors et al. 2016; Malmberg, Järvelä & Järvenoja 2017). Johnson & Davies (2014) proposed a model for learners' self-regulation that consists

of four elements: "Comprehending", "Planning", "Strategizing" and "Evaluating" (see figure 1).
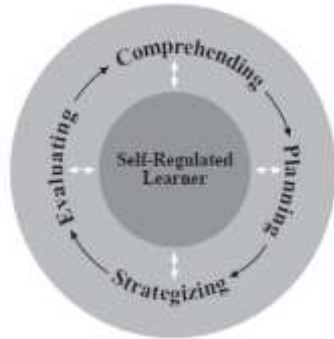
Figure 1. The cyclical cognitive processes of self-regulated learning (Johnson & Davies 2014).

As for the use of self-regulated for learners through e-learning platforms, some things must be considered like encouraging learners to self-plan for educational activities, following up the learners' performance and providing them with appropriate feedback and determining the self-evaluation criteria for learners (Carneiro et al. 2011 in Chelghoum 2017). Through his qualitative study, conducted at a Japanese university, 13 undergraduate students from the Faculty of Medicine participated showed the impact of self-regulated learning in the context of student-centered learning. Matsuyama et al. (2019) found that student-centered education strongly enhances self-regulated learning and makes students able to diversify their own learning strategies, which leads to the development of their level of performance and enhances their motivation towards learning.

To ensure highly efficient self-learning, Al Mamun, Lawrie & Wright (2020) proposed a four-stage strategy POEE (see Figure 2), which is used during the implementation of the activities, where the student sets his initial expectations to solve the activity and then moves to the stage of comparing the results with the predictions he made, and then comes the stage of justification and clarification of solutions up to the evaluation stage, which includes clarification and assessment of the level of understanding.
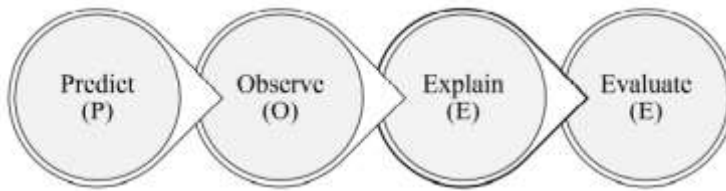
Figure 2. The stages of POEE strategy (Al Mamun, Lawrie & Wright 2020).

his study is based on exploring the impact of self-learning which is based on teacher support and facilitation on students' achievement and motivation on learning.

Onah & Sinclair (2017) conducted a mixed study to verify the effectiveness of self-based learning based on several behaviors related to self-organized learning by piloting a new tool on the MOOCs platform that provides the opportunity for the student to choose self-learning or teacher-led learning to participate in a Python programming course. 27 trainees participated in this course (16 males and 11 females). Onah & Sinclair (2017) claimed through this study that self-organized learning through some behaviors such as setting goals, planning, asking for help from peers or the teacher, and self-assessment was better in the group that adopted self-learning than the group that chose teacher-led learning. In addition, Self-directed learning is defined as the set of actions and behavioral activities that the student plans and initiates in their implementation and evaluation of their implemented activities to retrieve information (Caffarella & Merriam 2004; Sucipto, Ihsan & Wiyono 2019). Sucipto, Ihsan & Wiyono (2019) claim that there is a balanced relationship between student curiosity and self-directed learning.

2.3 Flipped classroom strategy:

To reach effective self-learning by students, the teacher must choose the appropriate strategy for his students, based on their self-efficacy and self-regulation. Perhaps the flipped classroom strategy is one of the most important strategies used recently because students have moved from direct learning in the classroom to distance learning due to the Corona pandemic, which led to the existence of large gaps in student learning.

Bishop & Verleger (2013) defined the flipped classroom strategy as that educational method based on a set of group learning activities in the classroom preceded by individual learning using technology outside the classroom. The flipped classroom is a type of blended learning in which students watch recorded videos of educational content before coming to class, and then work individually or in groups in the classroom on problem-solving and critical thinking activities, interspersed with dialogue, discussion, and presentations for questions (Kong, 2014).

Ibrahim & Callaway (2014) stress that using the flipped classroom strategy by students through watching video clips or reading some texts related to the topic outside of class time provides the greatest opportunity for students to focus on active work in the classroom by solving activities and problems.

El-Senousy & Alquda (2017) confirmed the effectiveness of the flipped classroom strategy based on self-learning by students, as the results obtained from his study in which 60 university students participated showed that the students who studied according to the flipped classroom strategy through self-preparation for study topics at home before attending school were their results in the post-tests was better than the students who studied by traditional method. As for Wang (2017), in his study of students' behavioral participation in online courses and its impact on student achievement in the flipped classroom in which 488 university students participated in Taiwan, he asserted that students' participation in engagingly designed problem-solving activities in the flipped classroom significantly affected the student achievement through self-reflection and self-assessment. Likewise, Haghighi et al. (2019) conducted a study on 60 students who were divided into two groups. One used the flipped classroom strategy through the Telegram app, where course materials and resources were disseminated through the app while the other received a traditional education. The results showed that the students of the first group (the flipped class) showed greater interaction with the course, and their achievement results in the post-test were better. In addition, most of the students of the first group enjoyed studying English in the flipped class through the Telegram application. This confirms that the

use of flipped classrooms as a means of promoting self-learning by students requires the active participation of students during the activities carried out in the classroom.

2.4 Learning Motivation:

Students' motivation to learn is divided into internal and external motivations. Internal and external motivations increase the learners' desire to achieve specific goals during the learning process. External factors include the strong relationship between teacher and student made possible by the availability of communication technology, while internal factors include the student's problem-solving abilities and learning skills (Aripova 2021). Increasing students' learning motivation has a significant impact on their achievement and performance (Alhadi & Saputra 2017). Dwijuliani et al. (2021) found by conducting a systematic review of previous literature that teachers play an important role in motivating and encouraging students to achieve their goals. In addition, action-based education has a positive impact on student performance and learning motivation compared to lecture-based education (Answer 2019). Gamification in the classroom would increase students' motivation to learn and their willingness to achieve learning objectives (Fuster-Guilló 2019). In a study conducted by El-Adl & Alkharusi (2020) to clarify the relationship between learning motivation and learner self-regulation in mathematics with the participation of 238 students from the ninth grade, it was found that the learner's internal and external motivations and self-efficacy contribute significantly to increasing self-regulation and therefore students who are motivated to learn and have confidence in their abilities have greater ability to learn.

2.5 Effective feedback:

There is no doubt that effective feedback plays a key role in the process of self-learning through educational platforms. It has taken various forms such as direct feedback during lessons or that is sent to learners via e-mail, dashboards or even phone calls from the teachers (Bodily & Verbert 2017), or comments on students' works. Therefore, the strength of the feedback lies in its quality and timeliness (Hattie &

Timperley 2007). Feedback can be defined as the information that indicates the extent to which the student understands a topic, how he learns, and his participation in various learning activities (Lim et al. 2021).

Lim et al. (2021) argue that process feedback is better than outcome feedback because it gives the learner a greater opportunity to identify their needs to fill their learning gaps. Moreover, effective feedback is the most important factor affecting the quality of learning for students (Pardo et al. 2017). During the implementation of the Flipped Classroom, learning performance improved due to the presence of a positive correlation between the personal feedback of learners and the effective teaching strategies (Matcha et al. 2019).

2.6 self-learning platforms

2.6.1 Global platforms

2.6.1.1 Coursera

Coursera is one of the most important self-learning platforms in the world because it offers a variety of training courses and programs for free for everyone. The platform has contributed to supporting the education of university students during the Corona pandemic by launching the Coursera for Campus platform, through which Coursera courses have been integrated with university programs. Moreover, Coursera platform is easy to use and has content translated into several languages. Videos with animations were used as an engaging introduction to the courses. In addition, the evaluation tasks at the end of each part of the content provide the opportunity for students to self-assess (O'Brien et al. 2017).

2.6.1.2 Udemy

The Udemy platform provides the opportunity for students to choose the right course for them by choosing from a wide range of courses that are offered in non-traditional ways based on skills and not indoctrination. Knowing that these courses have been

evaluated by the students who participated previously. In addition, the platform allows students to comment on the courses and discuss with the lecturer and other students. Most of the courses available are free and some are paid for at low prices.

2.6.1.3 Khan Academy

Khan Academy is one of the most important global platforms that students benefit from through the existing academic content. The platform provides a variety of resources for students in mathematics, science, and programming subjects in several languages. The platform provides free lessons to students in preparation for the most important international tests such as the SAT test and many university entrance exams. Åžan & Aykaç (2020) claims that the use of English language learning videos on the Khan Academy platform has made a remarkable progress in the students' achievement level, as the students who relied on the platform had better results than the students who relied on the prescribed curriculum in the post-tests conducted for them. Bayda & Sutliff (2020) found that the mathematical definitions included in the Khan Academy platform depend on the extracted definitions compared to textbooks that rely on the stipulated definitions, so they recommended that students should be taught both ways in presenting the mathematical definitions.

2.6.1.4 Edrakk

Edraak is one of the most important Arabic self-learning platforms, which offers many courses in Arabic. The platform provides detailed explanations of some Arab school curricula, which contributed greatly to supporting student learning during the Corona pandemic and the closure of most schools in the world. The platform is free and available to all categories, including undergraduates. In addition, the content is presented in interesting and enjoyable ways. On the other hand, Edraak platform attracts younger learners and girls more than global platforms (Ruipérez-Valiente et al. 2020). Moreover, when he compares between the Edraak platform and the EDX platform, Ruipérez-Valiente, Halawa & Reich (2019) found that the learners in Edraak

have a lower level of education, but they are more persistent in progress in achievement.

2.6.2 UAE platforms

There are many educational platforms used in the United Arab Emirates, the most important of which are the Madrasah platform and the Alef educational platform. Each of these platforms has its own advantages, as a Madrasa platform that allows students to access a diverse library of educational videos in Arabic in science and mathematics subjects, and teachers resort to it as an additional source of support for students during their learning process. While the Alef platform is an interactive platform that is used in schools on a daily basis in science, mathematics and other subjects such as Arabic, social studies and Islamic education.

2.6.2.1 Madrasa

Madrasa platform was launched in 2018 in the United Arab Emirates. The platform provided students with more than 5,000 educational videos translated into Arabic in mathematics, science, and Arabic language subjects (Madrasa 2022). The Ministry of Education in the United Arab Emirates has included the platform within the smart learning portal (LMS) to facilitate direct access by teachers and students.

2.6.2.2 Alef

Perhaps the shift to self-learning in the schools of the United Arab Emirates has begun to take a more serious form with the provision of educational platforms that support self-learning, such as the Alef platform for education, which began to be used in state schools since 2016 and is still continuing until now. Self-learning needs the learner to have some qualities such as self-efficacy and self-regulation, which would make this style of learning more effective and affect the level of students' achievement and motivation.

To investigate the impact of the smart environment and smart pedagogy on the performance of smart learners, Al-Naqbi & Mustaffa conducted a quantitative study

in which 347 students from public and private secondary schools in the United Arab Emirates participated. The results showed that the elements of the smart environment and smart pedagogy greatly affected the performance of students, and the study recommended the application of smart learning within the schools of the United Arab Emirates. Baniyassen (2020) confirmed through a mixed study of 300 students and 16 teachers that the use of social media platforms improves students' ability to write and speak in English. The researcher recommended the necessity of including social media in the educational process in the United Arab Emirates.

Alyammahi (2020) conducted a mixed study involving 7,039 students and 512 teachers from 12 public schools in the Emirate of Abu Dhabi on the impact of educational platforms on the performance of students and teachers. The study found that the use of these artificial intelligence-based platforms improved student achievement and increased the level of students' interaction with scientific content. In addition to alleviating the routine burdens of teachers, which made their role more effective in student learning. In another quantitative study conducted by Alyammahi (2017), it was concluded that the Alef Education platform enhanced students' motivation towards learning and gained them greater self-confidence towards independent learning.

CHAPTER 3: Methodology

3.1 Study Context

This study was conducted on secondary school students in governmental schools in the Emirate of Abu Dhabi. The researcher chose two boys' schools and two girls' schools to implement the study tools. The first school is Hamza Bin Abdulmotalab Secondary School for Boys in the city of Baniyas, west of Abu Dhabi Island, with a student population of 716 students. The second school is Zayed Althani Secondary School for Boys in Al Shawamekh City, west of Abu Dhabi Island, with a student population of 800 students. The third school is Salama Bint Bity Secondary School for Girls in Baniyas, with a student population of 750 students. The fourth school is Omamah Bint Al harith Secondary School for Girls, located in the city of Al-Wathba, west of the island of Abu Dhabi, with a student population of 350 students. Mathematics is taught to students at participating schools in the English language, relying mainly on the Alef Education platform, which has been included in government schools within the Emirate of Abu Dhabi since 2016. These schools were chosen in order to diversify the study participants in terms of gender and geographical location, in addition to being applied to use self-learning platforms as the Alef platform for education, which has been included in the educational system within these schools since 2017.

For quantitative data, the researcher will apply this study to students of the tenth and twelfth grades of the general and advanced streams in the four selected schools from Abu Dhabi governmental schools. In addition, 40 mathematics teachers from the four schools were asked to answer an open-ended questionnaire for a qualitative study.

3.2 Research Approach

In this study, the researcher will rely on the mixed method of data collection because this method gives more credibility to the results. The use of the mixed method in research reduces weaknesses (Bryman & Bell 2011) as it enriches knowledge related to the field of research and gives it greater value and depth (Molina-Azorin 2016). In

addition, this mixed approach of quantitative and qualitative data is used to compare these data after analysis to obtain "confirmation, disconfirmation, cross-validation, or corroboration" (Creswell 2009, p. 213). Moreover, "blending and integrating a variety of data and methods" (Jick 1979, p. 602) which is known as the triangulation method, leads to an increase in the credibility of the study and its results. According to Thurmond (2001); Molina-Azorin (2016), the triangulation method gives a deeper understanding of the problem of the study and enhances confidence in the data of the research. Therefore, the researcher seeks, through the tools of this study, to reach the extent of the impact of self-learning platforms on students' performance and motivation from the point of view of students and teachers at the same time. The qualitative data resulting from the interviews provide a greater explanation of the results of the quantitative data (King 1994).

3.3 Sampling Method

The researcher will apply this study to a sample of 1042 students and 40 teachers from four public secondary schools in the Emirate of Abu Dhabi, two schools for boys (Hamza Bin Abdulmotalab and Zayed Althani) and two schools for girls (Salama Bint Bity and Omamah Bint Al harith). For quantitative data, the participating sample will consist of 1042 students belonging to four government schools, distributed according to the following table:

Table2. Distribution of students participating in the study by grade and stream.

GRADE	STREAM	SCHOOL				Total
		Male		Female		
		Hamza Bin Abdulmotalab	Zayed Althani	Omamah Bint Al harith	Salama Bint Bity	
10	ADVANCED	24	32	24	28	108
	GENERAL	114	153	57	81	405

12	ADVANCED	52	32	17	26	127
	GENERAL	71	130	67	134	402
Total		261	347	165	269	1042

On the other hand, the sample participating in the qualitative study will consist of 40 teachers who teach mathematics in the selected schools for grades 9,10,11 and 12. The participating teachers will answer some open questions related to research questions about the impact of learning platforms that support self-learning on students' performance and motivation towards learning mathematics.

3.4 Instruments

For the purposes of collecting data related to the subject of the study. The researcher prepared two questionnaires, one for students and the other for teachers. The paragraphs of the student questionnaire were prepared by the researcher himself based on the requirements of self-learning, where the researcher divided the paragraphs into three-time stages before the class, during the class and after the class to show the impact of the self-learning platforms on the level of students' performance in mathematics. In addition to a special dimension of the impact of these platforms on motivating students to learn mathematics. As for the teachers' questionnaire, it included open-ended questions prepared by the researcher himself.

Students' questionnaire related to collecting quantitative data from students according to the five-Likert scale, and the second questionnaire for collecting qualitative data from teachers and it contains a set of open-ended questions. To ensure the validity of the study tools, the researcher presented them to a group of arbitrators, whose number reached 5, in order to verify the validity of the tools in terms of language and clarity. Based on the arbitrators' recommendations, all paragraphs were accepted, with some amendments made to some paragraphs.

The researcher sends the electronic questionnaire link to the teachers of the tenth and twelfth grades in the selected schools through the school leaders, who will send it to the students for implementation electronically. The student's questionnaire consisting of 3 sections. The first section contains the personal information of the participate (grade-level - educational stream - gender). The second section consists of 20 paragraphs related to the impact of using self-learning platforms on students' performance at three different times (before the class, through the class and after the class). The last section consists of 10 paragraphs related to the impact of using self-learning platforms on students' motivation towards learning. On the other hand, the researcher relied on the five-point Likert scale to evaluate the items of the questionnaire, which consists of Strongly Agree, Agree, Neutral, Disagree and Strongly Disagree. In addition, the researcher implemented the questionnaire on an exploratory sample of 20 students twice in a row, separated by 10 days, in order to ensure the validity and reliability of the tool before starting its actual implementation on the study sample.

As for the qualitative data, the teachers participating in the study will answer 3 open-ended questions related to the impact of using self-learning platforms on student achievement and motivating them towards learning, in addition to their suggestions on the mechanism for improving these platforms to become more effective in the educational process. The researcher will send an electronic link through which teachers can answer open questions, and the researcher will then receive the teachers' responses electronically without direct intervention from him, which ensures that there is no bias or interference by the researcher after that (Noble & Smith 2015). The researcher will then descriptively encode teachers' answers to each question to identify the main themes related to the question (Saldaña 2013), then link similar encodings together to arrive at a common theme (Gibbs 2007).

3.5 Procedure

To collect qualitative and quantitative data for this study, the researcher will obtain the necessary official approvals from ESE, which will facilitate the process of collecting data from the four participating schools. For this, the researcher obtained the research ethics approval in addition to a letter to whom it may concern from the British University in Dubai addressed to ESE to facilitate the researcher's task. The questionnaire for students and open questions for teachers will be prepared through the Microsoft Form program to be implemented electronically, in line with the precautionary measures inside schools due to the Corona pandemic. Due to the continuation of distance learning in government schools for the second semester 2021/2022, the researcher will implement the questionnaire for students and teachers by sending them an electronic link through which they can answer questions and send their responses.

Finally, the researcher will collect the data electronically through the Microsoft Form program and start analyzing the data using the IBM SPSS Statistics 28 software and AMOS 24.0 software.

3.6 Ethics

The study will be implemented on four public schools in the Emirate of Abu Dhabi, two schools for males and two schools for females. Accordingly, the researcher must obtain official approval from the ESE to allow the researcher to implement special questionnaires to study on students and conduct interviews with teachers.

Since the researcher works in one of these schools as a mathematics teacher, he must maintain a minimum of interference when implementing the questionnaires (Burgess 2005). On the other hand, the researcher must inform the participants of their right to withdraw at any moment.

CHAPTER 4: Data Analysis and Results

4.1 Introduction

In this chapter, the results of data analysis for study instruments are presented. The chapter starts with analysis of students' questionnaire pilot study, followed by analysis of the main students' questionnaire, and the teachers' questionnaire. The students' questionnaire is evaluated for validity and reliability using the AMOS 24.0 software, while IBM SPSS Statistics 28 software was used to run other statistical tests: descriptive statistics and correlation analysis. Item analysis was performed to create useful insights about students' activities before, during, and after class, i.e., to have a better view of the impact of using self-learning platforms on students' performance and motivation towards learning mathematics. Any statistical test is considered significant at $\alpha = 0.05$. Thematic analysis was used to analyze teachers' responses. Finally, triangulation of results is presented.

4.2 Pilot Study Results

A pilot study was conducted on two consecutive samples of 20 male students from grade 12 each, preliminary to the main study to examine the reliability of the students' questionnaire. Reliability analysis revealed that the overall questionnaire was satisfactorily reliable, Cronbach's $\alpha = 0.856$ for both samples. The two main constructs of the questionnaire were also satisfactorily reliable, Cronbach's $\alpha = 0.775$ and 0.807, for the effect on performance in sample 1 and sample 2, respectively and $\alpha = 0.640$ and 0.647 for the effect on motivation, in sample 1 and sample 2, respectively. For the effect on performance, the two subconstructs before class and after class were satisfactorily reliable, Cronbach's $\alpha > 0.6$ in both samples; however, the subconstruct during class was poorly reliable, Cronbach's $\alpha < 0.6$ in both samples.

Table 3. Reliability Statistics for Pilot Study.

Variables	Number of Items	Cronbach's alpha		Mean		SD	
		Sample 1	Sample 2	Sample 1	Sample 2	Sample 1	Sample 2
Overall Effect	**30**	**.856**	**.856**	**3.82**	**4.02**	**.463**	**.400**
Effect on Performance	20	.775	.807	3.73	3.90	.473	.444
Before class	5	.632	.687	3.45	3.68	.745	.703
During class	10	.446	.450	3.92	4.04	.433	.382
After class	5	.695	.715	3.63	3.85	.703	.622
Effect on Motivation	10	.640	.647	3.99	4.26	.480	.394

4.3 Students' Questionnaire

A total of 285 students were hired to answer the questionnaire, among which females represented 46.0%, while males represented 54.0% of the total sample. As for grades, 40.7% of students were at grade 10, while 59.3% were at grade 12. Also, 43.5% were in the general steam, while 56.5% were in the advanced stream. And finally, the majority 55.8% of students were at level of 80 or above, 35.1% were at 60 to below 80, and 9.1% were below 60.

Table 4. Students' Demographic Information (N = 285)

	Frequency	Percent		Frequency	Percent
Gender			**Grade**		
Female	131	46.0%	Grade 10	116	40.7%
Male	154	54.0%	Grade 12	169	59.3%
Stream			**Level**		
Advanced	161	56.5%	<60	26	9.1%
General	124	43.5%	60 to <80	100	35.1%
			>=80	159	55.8%

4.3.1 Measurement Validation

Confirmatory factor analysis (CFA) was performed to evaluate students' survey validity and reliability, using the software AMOS 24.0. According to Brown (2006), CFA is a type of structural equation modeling (SEM) that deals especially with measurement models. In the current study, we assessed two CFA measurement models. (1) first order CFA model including four latent variables: Before, During, After, and Motivation, drawn being linked by two-headed arrows to show covariance among them, shown in *Figure* , (2) second order model including the main latent variable: Performance, drawn being linked to the three latent variables (Before, During, and After) by one-headed arrows to show its impact on them, as shown in *Figure 4*.

Prior to assessing the model fit, these psychometric (validity and reliability) checks should be presented: Convergent Validity, Discriminant Validity, Composite Reliability, and Construct Reliability (Akgül, 2019).

4.3.2 Students' Measurement Model Psychometric Assessment

Convergent validity was assessed by item factor loadings (Regression Weights in AMOS output) with their statistical significance, factors' average variance extracted (AVE) and construct reliabilities (CRs). In order to establish convergent validity, an item factor loading should equal to or exceed 0.5 and its p-value should not exceed 0.05 (Hair, Black, Babin, & Anderson, 2009), AVE should equal to or exceed 0.5, and CR should equal to or exceed 0.7 (Fornell & Larcker, 1981). AVE and CR values were calculated using the following equations given by Fornell and Larcker (1981):

$$AVE = \frac{\sum_{i=1}^{n} \gamma^2}{(\sum_{i=1}^{n} \gamma^2) + (\sum_{i=1}^{n} \delta_i^2)}$$

$$CR = \frac{\sum_{i=1}^{n} \gamma^2}{(\sum_{i=1}^{n} \gamma_i)^2 + \sum_{i=1}^{n} \delta_i}$$

Where γ is the standardized factor load of item i under a particular configuration and δ is the measurement error of the indicator. **Construct *reliability*** was measured by Cronbach's alpha. In **Error! Not a valid bookmark self-reference.**, the results

indicated alpha values ranging between 0.812 and 0.948, satisfying the minimum threshold of 0.6 for exploratory research (Yusoff et al., 2011). To test the measurement model internal reliability, composite reliability (CR) was used (Fornells, 1981). All CR values presented in the table exceeded 0.7, demonstrating adequate internal consistency of data (Fornell and Larcker, 1981). AVE values ranged between 0.452 to 0.880, which prove convergent validity (Fornell and Larcker, 1981).

Table shows the elements of the student survey and the element loads of those items. Convergent validity was established because the factor loading values for all items were significant and greater than 0.5.

Construct reliability was measured by Cronbach's alpha. In **Error! Not a valid bookmark self-reference.**, the results indicated alpha values ranging between 0.812 and 0.948, satisfying the minimum threshold of 0.6 for exploratory research (Yusoff et al., 2011). To test the measurement model internal reliability, composite reliability (CR) was used (Fornells, 1981). All CR values presented in the table exceeded 0.7, demonstrating adequate internal consistency of data (Fornell and Larcker, 1981). AVE values ranged between 0.452 to 0.880, which prove convergent validity (Fornell and Larcker, 1981).

Table 5. Factor Loadings (Standardized Regression Weights), Cronbach's alpha (α), Composite Reliability (CR), and Average Variance Explained (AVE) from CFA of Students' Questionnaire

Variables	FL	α	CR	AVE
THE EFFECT OF USING SELF-LEARNING PLATFORMS ON STUDENTS' PERFORMANCE IN MATHEMATICS	-	.948	.957	.880
i. Before Class		.919	.812	.803	.452
1. I return to the self-learning platforms to review the previous lesson before starting the new lesson.	.556			
2. I do my homework using self-learning platforms at home before coming to school.	.697			
3. I look into the material required for the new lesson through self-learning platforms before attending class.	.660			

Variables	FL	α	CR	AVE
4. I look for some additional resources that will help me understand new lesson content through self-learning platforms.	.768			
5. I create questions related to the new lesson so that I can discuss them in class with my classmates.	.662			
ii. During Class	**.960**	**.909**	**.907**	**.496**
6. During the class, I follow the teacher's explanation for the lesson topic using the self-learning platform.	.679			
7. I carry out the instructions given by the teacher during the class.	.644			
8. I participate in individual and group activities through the self-learning platform during the class.	.722			
9. I asked the teacher when I find it difficult to understand the solution.	.587			
10. I make sure to complete the tasks required by the teacher on the self-learning platform during the lesson.	.731			
11. I discuss with my classmates the strategies for solving the required tasks before starting to implement them on the self-learning platform.	.691			
12. I am keen on documenting my work through the self-learning platform in the classroom for future use.	.741			
13. I am keen on getting feedback from the teacher about the tasks that I carry out on the self-learning platform during the class session.	.765			
14. I change the solution strategy used when executing tasks on the self-learning platform in case I did not succeed in solving them the first time.	.687			
15. I use the resources available on the self-learning platform during the session to better understand the content.	.776			
iii. After Class	**.935**	**.887**	**.889**	**.615**
16. I review the lesson at home after returning from school through the self-learning platform.	.724			
17. I do the required assignments on the on the self-learning platform at home.	.813			
18. I use the resources available to me on the self-learning platform when needed at home.	.849			
19. I review the new lesson content on the self-learning platform after returning from school.	.729			

Variables	FL	α	CR	AVE
20. I make sure to solve the additional activities and tasks that the teacher provides me with on the self-learning platform after returning from school.	.800			
THE EFFECT OF USING SELF-LEARNING PLATFORMS ON STUDENTS' MOTIVATION TOWARDS LEARNING MATHEMATICS	-	.937	.939	.606
21. I do my best to pay attention to the teacher's explanation in order to understand the lesson.	.689			
22. I feel strongly motivated towards learning mathematics through the self-learning platform.	.670			
23. I make sure to attend math class on time.	.772			
24. I strive to achieve the required learning objectives through the self-learning platform.	.854			
25. I make sure to win competitions conducted by the teacher through the self-learning platform during the class.	.730			
26. I make sure to get the badges available on the self-learning platform from the teacher.	.792			
27. I take the initiative to help my classmates during group activities on the self-learning platform.	.842			
28. I make sure to use the learning resources available on the self-learning platform when facing difficult questions.	.825			
29. Through the self-learning platform, I get resources for learning that are compatible with my personal abilities.	.771			
30. I do my best to get high scores in Mathematics by learning via the self-learning platform.	.815			

The discriminative validity of the four configurations was assessed by comparing the squared correlation between the configurations with the square root of the AVE. That is, the squared correlation between configurations must be less than the square root of AVE (Cooper & Zmud, 1990; Hair et al., 1998). The factor correlation matrix in Table shows the AVE square root along the diagonal, while the squared common variance values are plotted below the diagonal. The results showed that the square of the correlation value between the two components (0.826) was lower than the square root value of AVE (0.938), supporting the validity of the discrimination.

Table 6. Discriminant Validity of Students' Questionnaire

	Effect on Performance	Effect on Motivation
Effect on Performance	.938	
Effect on Motivation	.826	.778
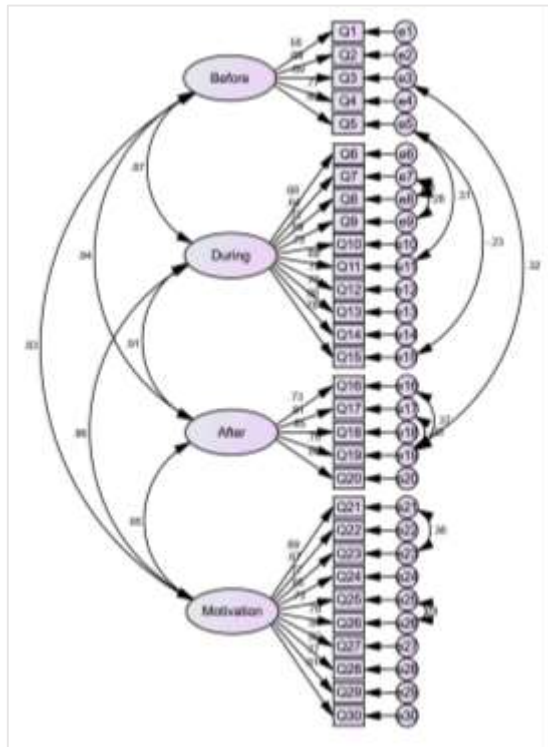
Figure 3. First Order CFA Model for Students' Questionnaire
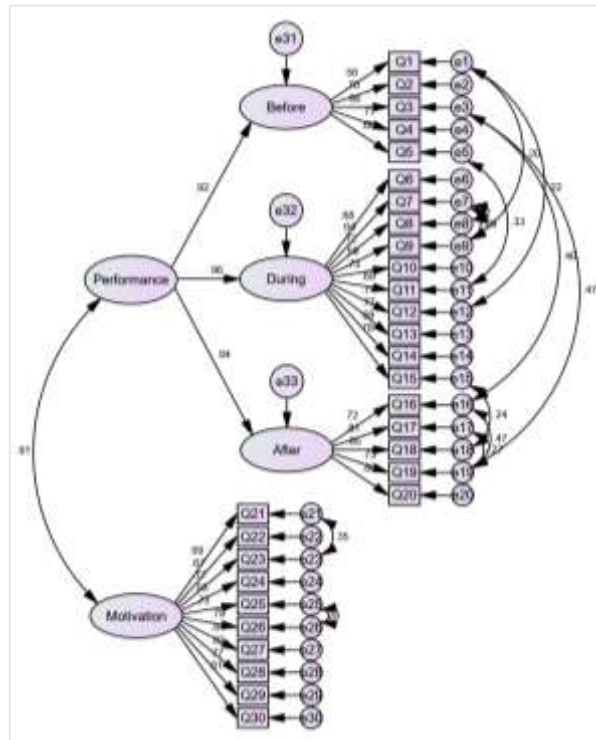
Figure 4. Second Order CFA Model for Students' Questionnaire

4.3.3 Model Fit

The maximum likelihood method was used to estimate the model parameters. The model fit indices are presented in **Error! Not a valid bookmark self-reference.**. The proposed two-factor model revealed an adequate fit outcome. Both models showed good model fit measures, and hence we can conclude that the overall model fit indices were acceptable based on the criteria proposed by the researchers;

however, the second order model showed a better fit based on the indices reported in the table. Therefore, the second model fits with the sample data.

Table 7. Fit Indices for Measurement Model of Student's Questionnaire

Index	Criterion	Model	
		1st Order	2nd Order
Chi-square (χ^2)	Lower is best	990.027	929.494
Degrees of freedom (df)	≥ 0	390	389
Probability (p-value)	$\geq .05$ (not necessary)	$< .001$	$< .001$
Normed Chi-square (χ^2/df)	< 3.0 (Byrne, 2010)	2.539	2.389
Comparative Fit Index (CFI)	$> .90$ (Hu and Bentler, 1999)	.902	.912
Tucker Lewis Index (TLI)	$> .90$ (Hu and Bentler, 1999)	.891	.901
Root Mean Square Error of Approximation (RMSEA)	$\leq .08$ (MacCallum et al, 1996)	.074	.070

4.3.4 Students' Perceptions about the Effect of Using Self-Learning Platforms

Based on the results from measurement validation section, i.e., the questionnaire was valid and reliable, so the composite variables of the questionnaire items can be calculated by averaging questionnaire items. Composite variables are summarized in **Table** , and checked for normality by examining skewness and kurtosis values along with histograms, see the Appendix. Descriptive statistics show that all variables follow an approximately normal distribution with no outliers.

Table 8. Descriptive Summary of Students' Perceptions (Composite Variables)*

Variables	M	Med	SD	Sk	Ku	Min	Max	RA
Overall Effect	3.99	4.03	.698	-1.29	3.38	1.00	5.00	79.8%
Effect on Performance	3.92	4.00	.708	-1.13	2.80	1.00	5.00	78.4%
Before Class	3.67	3.80	.816	-.69	.65	1.00	5.00	73.4%

Variables	M	Med	SD	Sk	Ku	Min	Max	RA
During Class	4.04	4.00	.702	-1.26	3.40	1.00	5.00	80.8%
After Class	3.95	4.00	.848	-1.22	2.21	1.00	5.00	79.0%
Effect on Motivation	4.13	4.20	.760	-1.49	3.60	1.00	5.00	82.6%

. M=Mean, Med=Median, SD=Standard Deviation, Sk=Skewness, Ku=Kurtosis, Min=Minimum, Max=Maximum, RA=Relative Agreement

Overall, the majority of students showed agreement to the questionnaire items, as shown in **Table** , overall relative agreement had a value of 79.8%, which shows relatively high agreement. Students also showed good agreement to the effect of self-learning platforms on their performance in mathematics (RA=78.4%), especially during class (RA=80.8%). They also indicated high agreement to the effect on their motivation towards learning mathematics (RA=82.6%).

4.3.5 Students' Perceptions by Demographics

In this section, students' perceptions are assessed by students' demographic information: gender, grade, stream, and level. For gender, grade, and stream group differences, independent-samples t test was performed, while a one-way ANOVA was performed to examine the significant differences level groups.

4.3.5.1 Gender Differences

We performed an independent sample t-test to see if there was a significant difference in student perception between males and females. This test found no statistically significant difference ($p > 0.05$); see **Table** .

Table 9. Independent-Samples *t* Test for Gender Differences

| | Gender Statistics | | | | t test | |
| | Male | | Female | | | |
Variables	M	SD	M	SD	t	Sig.
Overall Effect	3.96	.730	4.03	.657	-.941	.347
Effect on Performance	3.89	.746	3.96	.662	-.790	.430

Before Class	3.68	.844	3.65	.785	.397	.691
During Class	4.00	.722	4.08	.677	-.851	.395
After Class	3.87	.937	4.04	.722	-1.652	.100
Effect on Motivation	4.09	.793	4.19	.718	-1.121	.263

4.3.5.2 Grade Differences

Performing independent-samples t test to find significant difference between grade 10 and grade 12 in students' perceptions, there was no statistically significant differences found as all p-values exceeded the significance level of 0.05; check **Table** .

Table 10. Independent-Samples *t* Test for Grade Differences

	Grade Statistics					
	Grade 10		**Grade 12**		**t test**	
Variables	**M**	**SD**	**M**	**SD**	**t**	**Sig.**
Overall Effect	4.03	.717	3.96	.685	.819	.413
Effect on Performance	3.98	.713	3.88	.704	1.140	.255
Before Class	3.69	.823	3.65	.814	.393	.694
During Class	4.11	.681	3.98	.713	1.530	.127
After Class	4.00	.878	3.91	.827	.902	.368
Effect on Motivation	4.14	.812	4.13	.725	.133	.895

4.3.5.3 Stream Differences

The independent-samples t test performed to find significant difference between advanced and general streams in students' perceptions revealed that there was a statistically significant difference in all variables, p<0.01; see **Table** . For all types of effects, students in the advanced stream showed significantly higher mean scores than students in the general stream.

Table 11. Independent-Samples *t* Test for Stream Differences

	Stream Statistics					
	Advanced		**General**		**t test**	
Variables	**M**	**SD**	**M**	**SD**	**t**	**Sig.**

Overall Effect	4.12	.641	3.82	.734	3.674	<.001
Effect on Performance	4.05	.663	3.76	.735	3.417	<.001
Before Class	3.82	.770	3.47	.836	3.597	<.001
During Class	4.14	.649	3.90	.746	2.846	.005
After Class	4.09	.825	3.77	.846	3.215	.001
Effect on Motivation	4.28	.673	3.94	.826	3.732	<.001

4.3.5.4 Level Differences

We performed a one-way ANOVA and found significant differences between level groups in terms of student perception. The results showed that there was a statistically significant difference between the three level groups for all variables, as shown in **Table *1***. That is, p <0.01. The SPSS ANOVA procedure required a test of Levene's variance uniformity, and the results showed significant differences in performance and motivation impacts after class, thus determining the significance of the differences between level groups. Wales statistics were used instead of F to test. A post-multiple comparison test was requested using the ANOVA procedure to determine the significant difference for each pair in the level group. The test showed that for all types of effects, the mean for the "<60" group was statistically significantly lower than the mean for the other two groups, and a table of post-tests is attached.

Table 1. One-way ANOVA for Level Differences

	Level Statistics							
	<60		**≥60 to <80**		**≥80**		**Test**	
Variables	**M**	**SD**	**M**	**SD**	**M**	**SD**	**Statistic**	**Sig.**
Overall Effect	3.37	.807	3.95	.567	4.12	.698	14.776^F	<.001
Effect on Performance	3.30	.796	3.88	.580	4.05	.713	14.152^F	<.001
Before Class	2.85	.877	3.67	.698	3.80	.803	16.529^F	<.001
During Class	3.48	.803	3.98	.575	4.16	.712	12.010^F	<.001
After Class	3.37	1.011	3.89	.709	4.08	.861	6.289^W	.003
Effect on Motivation	3.51	1.040	4.07	.605	4.27	.743	7.690^W	.001

F: F statistic, W: Welch statistic

4.3.6 Item Analysis

Deeper insights could be extracted by summarizing frequencies of students' responses to the questionnaire items, as shown in **Table *2***, **Figure** , **Figure** , **Figure** , and **Figure** ; as percentages are presented on graphs. Relative agreement (RA) is a percentage for each item and construct is calculated by dividing the mean score by 5 (based on a five-point Likert scale), to indicate how far students agree with each item/construct. It can be seen from **Table *2*** that the overall RA is 79.8% indicating a relatively high agreement by students. The effect of using self-learning platforms on students' motivation towards learning mathematics had the highest RA of 82.6%. For items, RA values range between a minimum of 72.8% for item 22 (I feel strongly motivated towards learning mathematics through the self-learning platform) and maximum of 89.1% for item 21 (I do my best to pay attention to the teacher's explanation in order to understand the lesson). This indicates a high impact of using self-learning platforms on students' motivation towards learning mathematics. The RA value for the effect of using self-learning platforms on students' performance in mathematics is 78.4%, which also indicates high impact. The impact was at its highest during class (RA=80.7%) and at its lowest before class (RA=73.3%).

Table 2. Frequencies of Students' Questionnaire Items (RA=79.8%)

Variables	SD	D	N	A	SA	RA
THE EFFECT OF USING SELF-LEARNING PLATFORMS ON STUDENTS' PERFORMANCE IN MATHEMATICS						**78.4%**
iv. Before Class						**73.3%**
1. I return to the self-learning platforms to review the previous lesson before starting the new lesson.	16	26	88	103	52	70.5%
2. I do my homework using self-learning platforms at home before coming to school.	11	22	39	120	93	78.4%
3. I look into the material required for the new lesson through self-learning platforms before attending class.	16	43	64	109	53	69.8%
4. I look for some additional resources that will help me understand new lesson content through self-learning platforms.	11	16	43	135	80	78.0%

Variables	SD	D	N	A	SA	RA
5. I create questions related to the new lesson so that I can discuss them in class with my classmates.	18	39	69	101	58	70.0%
v. During Class						**80.7%**
6. During the class, I follow the teacher's explanation for the lesson topic using the self-learning platform.	11	8	31	136	99	81.3%
7. I carry out the instructions given by the teacher during the class.	5	6	17	107	150	87.4%
8. I participate in individual and group activities through the self-learning platform during the class.	7	8	34	127	109	82.7%
9. I asked the teacher when I find it difficult to understand the solution.	8	9	34	106	128	83.6%
10. I make sure to complete the tasks required by the teacher on the self-learning platform during the lesson.	9	13	38	125	100	80.6%
11. I discuss with my classmates the strategies for solving the required tasks before starting to implement them on the self-learning platform.	9	24	55	123	74	76.1%
12. I am keen on documenting my work through the self-learning platform in the classroom for future use.	10	18	50	125	82	77.6%
13. I am keen on getting feedback from the teacher about the tasks that I carry out on the self-learning platform during the class session.	8	15	45	134	83	78.9%
14. I change the solution strategy used when executing tasks on the self-learning platform in case I did not succeed in solving them the first time.	7	9	54	132	83	79.3%
15. I use the resources available on the self-learning platform during the session to better understand the content.	7	12	46	131	89	79.9%
vi. After Class						**79.0%**
16. I review the lesson at home after returning from school through the self-learning platform.	16	20	59	118	72	74.7%
17. I do the required assignments on the self-learning platform at home.	10	8	26	109	132	84.2%
18. I use the resources available to me on the self-learning platform when needed at home.	10	7	29	134	105	82.2%
19. I review the new lesson content on the self-learning platform after returning from school.	15	29	69	101	71	72.9%

Variables	SD	D	N	A	SA	RA
20. I make sure to solve the additional activities and tasks that the teacher provides me with on the self-learning platform after returning from school.	9	14	36	124	102	80.8%
THE EFFECT OF USING SELF-LEARNING PLATFORMS ON STUDENTS' MOTIVATION TOWARDS LEARNING MATHEMATICS						**82.6%**
21. I do my best to pay attention to the teacher's explanation in order to understand the lesson.	8	1	16	89	171	89.1%
22. I feel strongly motivated towards learning mathematics through the self-learning platform.	18	27	67	100	73	72.8%
23. I make sure to attend math class on time.	9	3	22	97	154	86.9%
24. I strive to achieve the required learning objectives through the self-learning platform.	6	5	40	123	111	83.0%
25. I make sure to win competitions conducted by the teacher through the self-learning platform during the class.	8	12	48	115	102	80.4%
26. I make sure to get the badges available on the self-learning platform from the teacher.	7	10	41	107	120	82.7%
27. I take the initiative to help my classmates during group activities on the self-learning platform.	9	7	35	110	124	83.4%
28. I make sure to use the learning resources available on the self-learning platform when facing difficult questions.	8	8	40	121	108	82.0%
29. Through the self-learning platform, I get resources for learning that are compatible with my personal abilities.	10	12	46	120	97	79.8%
30. I do my best to get high scores in Mathematics by learning via the self-learning platform.	6	6	24	106	143	86.2%

4.3.6.1 Effect of using Self-Learning Platform on Students' Performance in Mathematics before Class.

The most preferred actions by students before class is to do their homework using self-learning platforms at home before going to school (RA=78.4%) and look for some additional resources that will help them understand new lesson content through self-learning platforms (RA=78.0%).

Effect of Self-Learning Platform on Students' Performance in Mathematics before Class

Legend: Srongly Disagree ■ Disagree □ Neutral ■ Agree ■ Stongly Agree

Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I return to the self-learning platforms to review the previous lesson before starting the new lesson.	6%	9%	31%	36%	18%
I do my homework using self-learning platforms at home before coming to school.	4%	8%	14%	42%	33%
I look into the material required for the new lesson through self-learning platforms before attending class.	6%	15%	23%	38%	19%
I look for some additional resources that will help me understand new lesson content through self-learning platforms.	4%	6%	15%	47%	28%
I create questions related to the new lesson so that I can discuss them in class with my classmates.	6%	14%	24%	35%	20%

Figure 5. Percentage for Effect of Self-learning Platform on Students' Performance in Mathematics before Class.

4.3.6.2 Effect of using Self-Learning Platform on Students' Performance in Mathematics during Class.

The most preferred actions by students during class is to carry out the instructions given by the teacher during the class (RA=87.4%), which indicates high effect of using the platforms in students' performance in terms of following teacher's instructions during the class. Based on the value of RA=83.6%, students ask the teacher when they find it difficult to understand the solution. So, it seems the using self-learning platforms are effective in engaging students during the class. Also, one of the high impacts of using self-learning platforms on students' performance in mathematics is participating in individual and group activities through the self-learning platform during the class (RA=82.7%). Check **Table *2*** and **Figure** to see all activities during class.
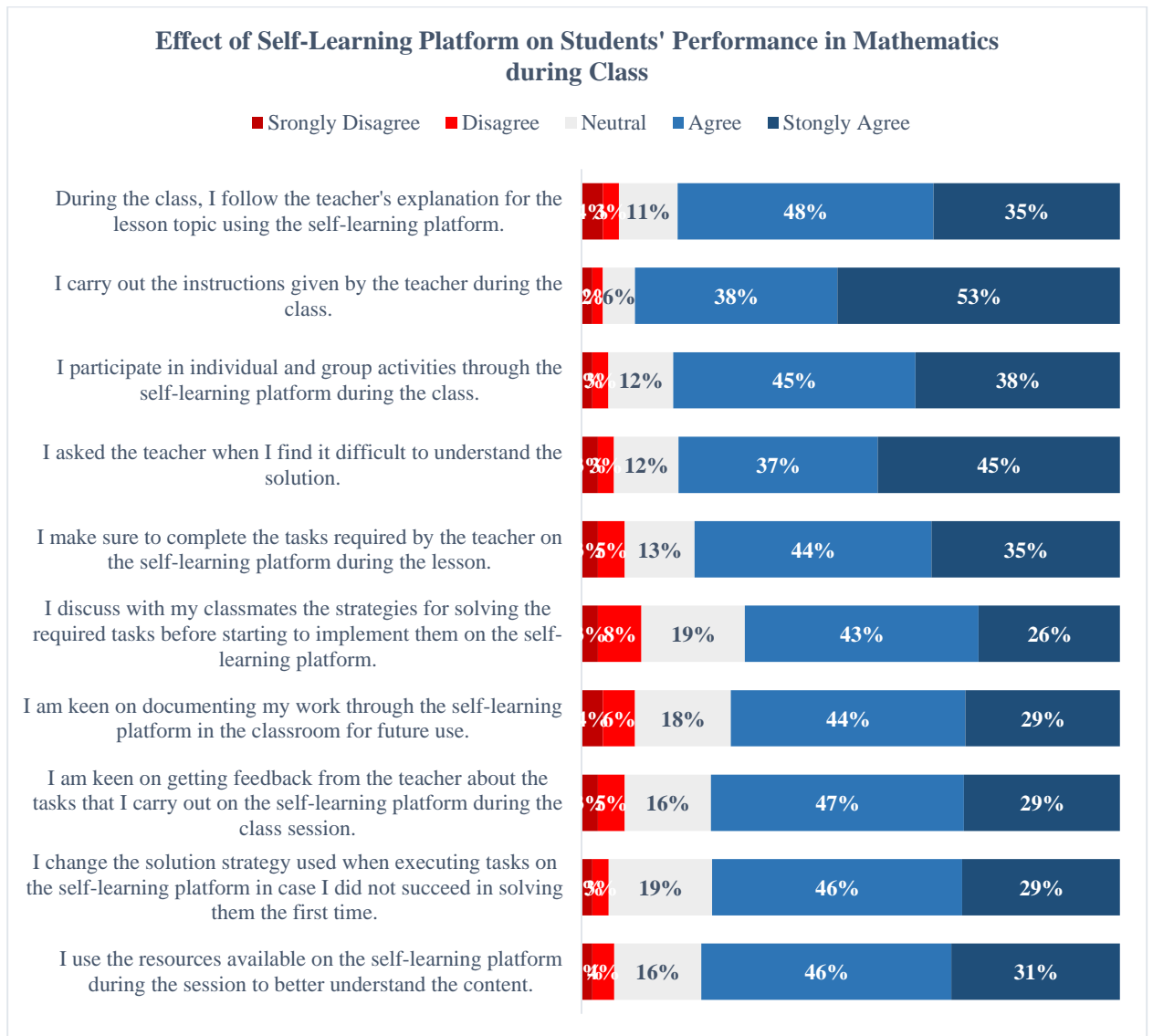
Figure 6. Percentage for Effect of Self-learning Platform on Students' Performance in Mathematics during Class.

4.3.6.3 Effect of using Self-Learning Platform on Students' Performance in Mathematics after Class.

After class, it seems that the highest impact of using self-learning platforms was through doing the required assignments on the self-learning platform at home (RA=84.2%). Also, as RA=82.2%, using the resources available on the self-learning platform when needed at home is one of the important effects. Students also make sure

to solve the additional activities and tasks that the teacher provides them with on the self-learning platform after returning from school (RA=80.8%).

Effect of Self-Learning Platform on Students' Performance in Mathematics after Class

■ Srongly Disagree ■ Disagree ■ Neutral ■ Agree ■ Stongly Agree

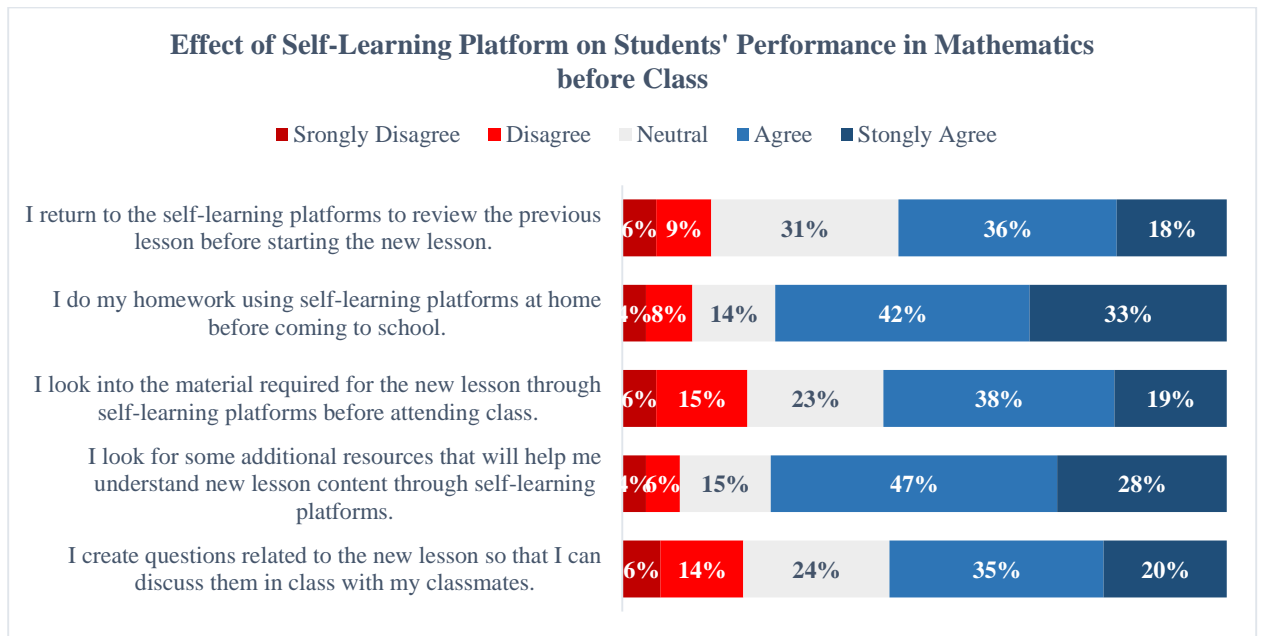|					
I review the lesson at home after returning from school through the self-learning platform.	6%	7%	21%	41%	25%
I do the required assignments on the on the self-learning platform at home.	4% 3%	9%	38%	46%	
I use the resources available to me on the self-learning platform when needed at home.	4% 2%	10%	47%	37%	
I review the new lesson content on the self-learning platform after returning from school.	5% 10%	24%	35%	25%	
I make sure to solve the additional activities and tasks that the teacher provides me with on the self-learning platform after returning from school.	2% 5%	13%	44%	36%	

Figure 7. Percentage for Effect of Self-learning Platform on Students' Performance in Mathematics after Class.

4.3.6.4 Effect of using Self-Learning Platform on Students' Motivation towards Learning Mathematics

The highest impact of using self-learning platforms on students' motivation towards learning mathematics was that students do their best to pay attention to the teacher's explanation in order to understand the lesson (RA=89.1%). The least impact was that students feel strongly motivated towards learning mathematics through the self-learning platform (RA=72.8%); yet it's still relatively high impact. Nevertheless, more motivational activities needed on these platforms for students to feel more motivated towards learning mathematics.

Effect of Self-Learning Platform on Students' Motivation towards Learning Mathematics

Legend: Srongly Disagree ■ Disagree ■ Neutral ■ Agree ■ Stongly Agree

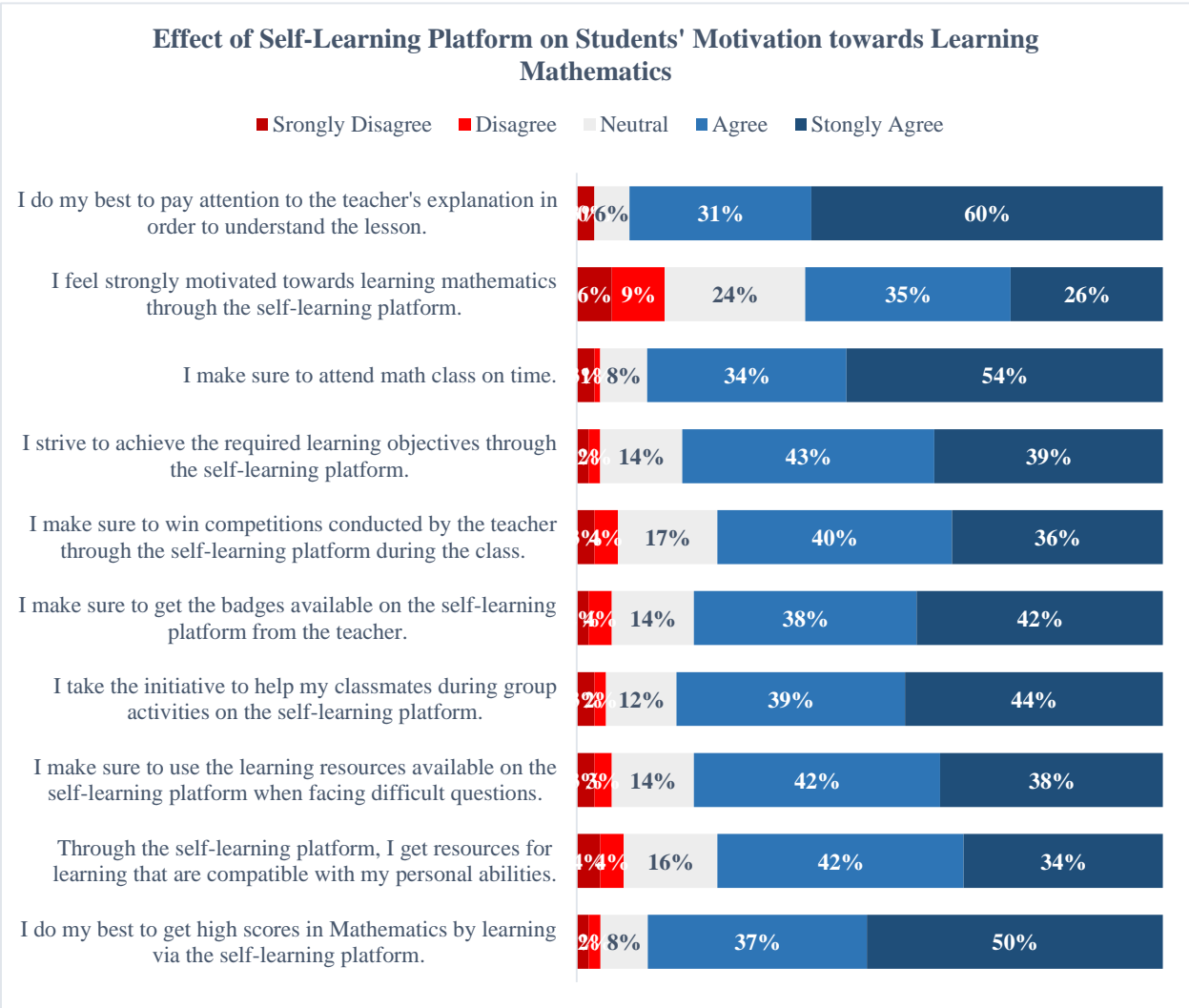| Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I do my best to pay attention to the teacher's explanation in order to understand the lesson.			6%	31%	60%
I feel strongly motivated towards learning mathematics through the self-learning platform.	6%	9%	24%	35%	26%
I make sure to attend math class on time.		8%		34%	54%
I strive to achieve the required learning objectives through the self-learning platform.			14%	43%	39%
I make sure to win competitions conducted by the teacher through the self-learning platform during the class.		4%	17%	40%	36%
I make sure to get the badges available on the self-learning platform from the teacher.		4%	14%	38%	42%
I take the initiative to help my classmates during group activities on the self-learning platform.			12%	39%	44%
I make sure to use the learning resources available on the self-learning platform when facing difficult questions.			14%	42%	38%
Through the self-learning platform, I get resources for learning that are compatible with my personal abilities.		4%	16%	42%	34%
I do my best to get high scores in Mathematics by learning via the self-learning platform.			8%	37%	50%

Figure 8. Percentage for Effect of Self-learning Platform on Students' Motivation towards Learning Mathematics.

4.3.7 Correlation Analysis

Correlation analysis was conducted, and Pearson's r correlation coefficients were computed to measure the relationships between research variables. The analysis results are presented in **Table 3**, indicating strong positive relationships between all variables. Pearson's r correlation coefficients ranged between 0.725 to 0.949.

Table 3. Pearson's r Correlation Coefficients

	Effect on Performance			
	Overall	Before class	During class	After class
Effect on Performance	1			
Before Class	.887[*]	1		
During Class	.949[*]	.744[*]	1	
After Class	.917[*]	.770[*]	.800[*]	1
Effect on Motivation	.835[*]	.725[*]	.800[*]	.766[*]

*. *Correlation is significant at the 0.01 level (2-tailed).*

4.3.7.1 Correlation Analysis across Groups

Correlation analysis was conducted across demographic groups of respondents to measure the relationships between variables in each demographic group. In **Table *4***, Pearson's r correlation coefficients for gender groups are presented, indicating similar significant relationships (strong positive) between variables in both groups, males and females. Correlations were investigated across Grade groups, as seen in **Table 5**, and the results show that both grades 10 and 12 had similar relationships, which are strong and positive significant relationships between variables. Similarly, the same relationship patterns were detected across stream groups: Advanced and General, see **Table *6***. Finally, examining the relationship between Effect on Performance and Effect on Motivation by Level indicated that the correlation coefficients in levels "≥60 to <80" and "≥80" were higher than the correlation coefficient in level "<60", in the overall effect on performance and after class.

Table 4. Pearson's r Correlation Coefficients by Gender

	Effect on Performance							
	Overall		Before Class		During Class		After Class	
	M	F	M	F	M	F	M	F
Effect on Performance	1	1						
Before Class	.897[*]	.879[*]	1	1				
During Class	.947[*]	.953[*]	.760[*]	.728[*]	1	1		

After Class	.917*	.924*	.784*	.770*	.788*	.827*	1	1
Effect on Motivation	.822*	.852*	.739*	.713*	.801*	.798*	.717*	.853*

. Correlation is significant at the 0.01 level (2-tailed).

Table 5. Pearson's r Correlation Coefficients by Grade

	Effect on Performance							
	Overall		Before Class		During Class		After Class	
	G10	G12	G10	G12	G10	G12	G10	G12
Effect on Performance	1	1						
Before Class	.899*	.880*	1	1				
During Class	.952*	.948*	.766*	.732*	1	1		
After Class	.930*	.908*	.794*	.752*	.824*	.784*	1	1
Effect on Motivation	.834*	.840*	.741*	.714*	.822*	.794*	.740*	.790*

. Correlation is significant at the 0.01 level (2-tailed).

Table 6. Pearson's r Correlation Coefficients by Stream

	Effect on Performance							
	Overall		Before Class		During Class		After Class	
	A	G	A	G	A	G	A	G
Effect on Performance	1	1						
Before Class	.879*	.885*	1	1				
During Class	.935*	.962*	.698*	.775*	1	1		
After Class	.924*	.904*	.797*	.718*	.780*	.811*	1	1
Effect on Motivation	.832*	.825*	.691*	.734*	.797*	.792*	.775*	.744*

. Correlation is significant at the 0.01 level (2-tailed).

Table 7. Pearson's r Correlation Coefficients by Level

	Effect on Performance											
	Overall			Before Class			During Class			After Class		
	<60	60:80	≥80	<60	60:80	≥80	<60	60:80	≥80	<60	60:80	≥80
Effect on Performance	1	1	1									
Before Class	.844*	.868*	.887*	1	1	1						
During Class	.958*	.945*	.942*	.726*	.725*	.720*	1	1	1			
After Class	.895*	.886*	.928*	.635*	.682*	.814*	.799*	.758*	.796*	1	1	1

| Effect on Motivation | .677[*] | .844[*] | .848[*] | .699[*] | .695[*] | .707[*] | .648[*] | .811[*] | .809[*] | .496[*] | .764[*] | .813[*] |

. Correlation is significant at the 0.01 level (2-tailed).

4.4 Teachers' Open-ended Questionnaire

An inductive approach was used to analyze teachers' responses to the interview questions, using a thematic analysis method. This method starts with weeding out biases and establishing researcher's overarching impressions of the data and identifying common themes. The interview questions main aim was to answer the following questions:

1. how can self-learning platforms play an important role in improving students' performance in mathematics?

2. how can self-learning platforms play an important role in improving students' motivation towards learning mathematics?

3. what are the needs of the self-learning platforms currently used to become more effective in promoting self-learning for students in mathematics?

4. comments or suggestions

Answers to these questions were collected from 19 teachers, registered in an Excel spreadsheet, and analyzed by subject analysis. Subject analysis is a qualitative research method for identifying, analyzing, organizing, explaining, and reporting the subjects found in a dataset (Braun & Clarke, 2006). A linear 6-phase thematic analysis documented by Braun & Clarke (2006) was applied. However, in reality, this is a repetitive and reflexive process that evolves over time and constantly moves back and forth between stages, see *Figure* .
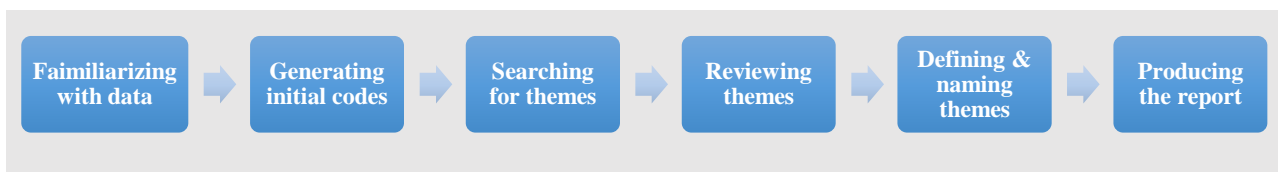

Figure 9. Linear, Six-phased method of Thematic Analysis, by Braun and Clarke (2006).

By applying thematic analysis method, the researcher started first reading all teachers responses for the four interview questions to get familiarize with the data. Initial codes were written next to each response in the Excel sheet, then themes started to appear. After themes were extracted, subthemes could be collected to point out main theme different topics. The themes and subthemes emerged from the analysis can be reviewed in **Table 8**; detailed discussion of results is presented below the table.

Table 8. Thematic Analysis Results (*N*=19)

Main Themes	Subthemes	Core points
• **Student self-dependence**	• Progress	• Students can address their weakness points and improve them
	• Control	• Students have control on their learning process • They can use the platform any time anywhere and even from any available device • They can see contents as many times as they need
• **Platform design**	• Technology integration	• Technology-education integration increases students' interest in learning mathematics • Platforms have interactive resources like: games • Platforms need to be more interactive
	• Communication	• Platform-parents communication • Teacher-student communication • More communication is needed
	• Assessment/rewarding systems	• Practices, assignments, and tests • Marking and grading system • Motivational rewards • There should be more motivational rewarding
• **Platform Content**	• Diversity of resources	• Suitable content for all students' levels • Diverse resources for all students • Stacked curriculum needs to be updated • Questions bank needs to be updated
	• Language	• Platforms need to have content in different languages to suit all students

• **Other considerations**	• Students should use a single platform
	• Time

4.4.1 Students' Self-dependence

The most observed theme within teachers' responses was that using self-learning platforms allow students to improve their self-dependence, i.e., they can depend on themselves as they do most of the learning process on their own. More specifically, as there are two subthemes emerging under this main them, students can watch their own progress, and they have more control on their own learning process.

4.4.1.1 Progress

The majority of teachers unanimously think that using self-learning platforms help students following-up their progress in mathematics and address their own weaknesses so that they can work on and improve them. Moreover, they can choose what to work on based on their own interests in areas of mathematics. One of the teachers stated: "*During self-study, students learn at their own pace, focusing more on areas that interest them the most or that which they understand better.*" (Teacher 1) Teachers believe that using these platforms help enhance students' ability to depend on themselves in solving mathematical problems as they can improve their weakness points by reading explanations and using the platform practices. Students can use the different questions available, and they have the opportunity to change their answers when they make a mistake. A teacher said: "*In mathematics in particular, the student needs to practice various ideas, and this is what self-learning platforms provide.*" (Teacher 12)

Teachers believe that these platforms can develop self- regulating learners who could monitor their own thinking and reasoning and are able to see applications and modeling of mathematics concepts. They also talked about how this modern way of learning can uplift some of the stress put on students when they are in traditional classrooms. Teacher (18) said: "*Students can realize where they are in Mathematics, they can use each platform with full freedom to improve their level without any stress.*"

In addition, students feel bored listening to teachers in the classroom; *"Listening to a teacher talking for 30 minutes to an hour at a time can be boring and exhausting for a student."* (Teacher 6)

4.4.1.2 Control

It was clear that all teachers believe that students can manage the learning process on their own and according to their own pace and terms, when they use these platforms. Teacher (6) stated: *"Self-learning allows students to get the information they need at their own pace, where they can pause and play at the critical moments for them…"* then he added: *"…In addition to this, self-learning platforms allow students to learn under their own terms. This could mean at home after school, where they can eat and drink, listen to music and take breaks as often as they need."*

4.4.2 Platform Design

From the point of view of teachers, platform design was one of the effective factors influencing students' performance and motivation in learning mathematics. Platform design includes essential components like technology integration, communication, and assessment and rewarding systems.

4.4.2.1 Technology-Education Integration

As teachers indicated, educational platforms are designed using modern technology that provide interactive tools for students to be able to understand, practice, and learn mathematics. *"Increasing students' motivation to learn mathematics by integrating technology with education by using and employing programs that arouse their interest and increase their motivation towards it… Empowering teachers and students with the skills of the twenty-first century."* (Teacher 10) Teachers believe that the availability of the content on the platform is effective in improving students' performance. Teacher (14) said: *"The best feature is students can revive back to any topic of their choice to get their doubts clear. They can repeatedly watch their lecture to understand better. The platform has to make the content specific no matter from which level the platform has to teach the concept to the students."* Teacher (15) added: *"Instead of having a*

mathematics concept explained to them, they use instructions, context clues, and examples to figure out the answer on their own."

Teachers indicated that the platform design includes tools that help students sharpen their senses in solving the questions with enjoyment, like a puzzle game. Another aspect of the platform is the full stars score; as Teach (4) said: *"The way this platform is designed gives the students a good feeling when they get a "Full Stars Score" or 100%. Also, the stars that the teacher could use during the self-learning process in order to motivate the students to learn more."* Teacher (5) also said: *"The educational platforms contain educational games - student assessment on a continuous basis consolidates the concepts and skills of mathematics and increases their motivation."* Moreover, teachers stated that the design of the platforms can also boost students' motivation as students can pause the online lecture whenever they don't understand or they can skip parts that are too easy, which keeps them engaged and alert, as Teacher (7) stated: *"Students get to decide if they wish to progress slowly or rapidly."*

In addition, teachers mentioned that graphical illustrations aligned with artificial intelligence are well grabbed by students, and games incorporated have the same influence on students; that is, an interactive environment. *"The attractive environment inside the platform and the motivation represented in assigning rewards to students and the diversity of activities contribute to the student's demand for the platform, and thus this is reflected in the development of his level in the subject."* Teacher (16)

However, Teacher (1) suggested that the platform needs to be on mobiles. Teacher (3) also suggested that there should be more ways to solve mathematics equations. The majority of teachers also have the desire of more interactive platforms to motivate the students to learn more. Teachers believe that self-learning platforms need to be more user-friendly and more interactive, to have variety of resources, to have easy and effective administration and reporting, and to have sample assignments. They believe computer is an essential means to attract students' attention, so that platforms need to be interesting; *"...as the Chinese proverb said: What I hear I forget, what I see I remember, and what I do with my hands I learn."* (Teacher 13)

Finally, teachers strongly believe in the role of technology and new tools in improving self-learning skills and motivating students. Teacher (14) stated: *"Today in the modern world where we can access any things through the internet sitting in any corner of the world…"* He added: *"… with the advancement of technology, it has become habitual to most individuals. Nowadays, you can learn how to do anything with a mere YouTube tutorial, or learn an entirely new language with a single app. The need for the self-learning platform to become more effective in promoting self-learning firstly is choosing a credible source of learning. Having a visual understanding so that students learn better what they see. Usage of diagrams and flow charts could be a good idea for helping students learn better."*

Teachers believe that the current platform designs need to be updated as they have a lot of stereotypes, and their style does not depend on the active method that makes the student an essential element in the production of the rule or the law. Teacher (4) said: *"Making the platforms more childish for the students (boys or girls) so they would feel happy during the learning process (Learn and have fun too!)."* Also, Teacher (18) said: *"I think we need to add more interactive activities, they will get more interest in subject and improve their level."*

4.4.2.2 Communication

Communication is an important factor in improving students' performance and motivation, represented in students' relationship with their teachers and platform communication with student parents. Platforms also assist teachers in following up with their students outside of work hours. *"…communicate with parents in case the student does not enter the platform."* (Teacher 19) Teachers also suggested the platforms to be more communicating; Teacher (6) stated: *"I believe the students need support from teachers, parents and siblings to encourage the use of the self-learning platforms."* So, they think that raising awareness of the family about the need to follow up on their children and urging them to use learning platforms effectively is essential. Teacher (10) added this comment: *"activating the educational function of the family and integrating it into the process of tracking and keeping up with the children, and*

in creating an appropriate atmosphere for distance learning in the family environment based on communication and positive family and community interaction..."

Teachers believe that educators' role is very important in making a successful move to inspire, support, and hold young people accountable to direct their own learning. Teacher (8) stated: *"The use of the flipped lesson approach, in my opinion, is a technique based on self-learning through educational platforms that enhances the student-teacher communication skill."* Another comment added by Teacher (11) was: *"Learning Management System (LMS) allows administrators instant access to update the content of courses or to add materials and resources for students for immediate access."*

4.4.2.3 Assessment/Awarding System

The current self-learning platforms are provided with assessment, evaluation, and rewarding systems that enable students to follow up their mathematical skill level. Teacher (1) said: *"...Learning Management System (LMS) these days has a great role in increasing students' motivation, as it comes with adequate tools that let students be vigilant of their assessment performance."* Platforms give periodical marking so that students can follow up their performance and make them obliged to return back to the platform. Teachers also can use stars during the self-learning process in order to motivate the students to learn more. As said by Teacher (5): *"...rewards given and marks by these platforms enhance student motivation. The educational platforms contain educational games and student assessment on a continuous basis, which consolidates the concepts and skills of mathematics and increases their motivation."* So, the rewarding system is very effective; *"...through motivating mechanisms and the stars and medals that students get during their learning stages, educational platforms play an essential role in improving students' motivation."*, said by Teacher (8). Another point in the rewarding system that was mentioned is that the rewarding system is also used in conducting competitions among students and the winner is honored, which stimulates students' motivation to learn more.

Teachers suggested also updating grading system based on platform activation, assigning material prizes to the most participating students, and sharing the results of the most participating students so that they can be role models for others.

4.4.3 Platform Content

The material and content on self-learning platforms play a major role in enhancing students' performance and motivation to learn. As learned from teachers' responses, these platforms are useful for students when they provide different levels of learning materials that would suit all academic levels of students. Teacher (13) stated: *"self-education has become a great goal because it is effective and effective as it is an effort that depends on the learner, his desire and eagerness to learn, and is compatible with the levels and interests of the learner's abilities."*

4.4.3.1 Diversity of Resources

Teachers believe that a useful platform has to have plenty of learning applications and exercises on mathematics, which will improve a student's overall achievement and hence increase their self-confidence. *"If the platforms provide the needs of students in terms of their suitability for learning outcomes and their suitability for grading in student levels."* (Teacher 12)

Teacher (15) gave an example of a new way in learning mathematics that would help students improve their mathematical creative thinking abilities and hence motivate them to learn, as he said: *"An example could be adding the numbers from 1 to 100. Rather than adding the numbers in sequence, students add the first and last (1 + 100 = 101), and then the second and next-to-last (2 + 99 = 101), and so on. Then all they have to do to get the required sum is solve 50 × 101 = 5,050. The exercise will give students an enlightening experience with a truly lasting effect. There are patterns that can be motivating, especially if they are discovered by the student."* It was obvious from teachers' opinions, that the diversity of activities on the platform contribute to students' demand for it. About how self-learning platforms play an important role in

improving students' motivation, Teacher (19) stated: *"If it includes some simple concepts and games. Make tests and ask questions from the platform to encourage the student."*

On the other hand, teachers indicated that the current platforms lack gradation in the questions from easy to difficult (e.g., ALEF). They also suggested that the questions bank needs to be updated by adding new questions every year so that the students don't get the answers from former students. They also suggested adding material that help students research skills, critical thinking skills, dialogue and interaction skills, and self-learning; and this can be by linking curricula to life and the environment. About what needs of the self-learning platforms currently used to become more effective in promoting self-learning for students in mathematics are, Teacher (12) stated: *"The way the questions are presented clearly. The compatibility of the questions in the platforms with the learning outcomes."* Also, Teacher (15) suggested that for a platform to be effective, it needs to:

- Set realistic goals for students' according to their level of understanding in mathematics
- Find what works for the students in each area of mathematics.
- Review the topic the same day students learn it.
- Study in short, frequent sessions
- Start from the basics of each topic where the students can learn and understand easily
- Tricks and Tips to Learn Math Easily.
- Strategies in learning mathematics to help increase students' mathematical knowledge and improve math outcomes
- Provide authentic problems that increase students' drive to engage with math

Teacher (17) also suggested linking student's academic progress to passing a specific program for the subjects he needs, such as Alex. Finally, Teacher (19) stated that some platforms contain very difficult and unnecessary material: *"The Ministry's exams include some platform questions imposed by the Ministry. Reducing the number of questions for each lesson to make it easier for the student to perform and the teacher*

to follow." So as other teachers commented that it is important to make the content of learning easier, simpler, and more accessible for the students. *"The session provided by the institution must be an interactive and double-ended conversation and not a monotonous lecture that bores a student."* (Teacher 14)

In conclusion, there was a general agreement by teachers that the content or curriculum must be updated, because it affects other subjects they learn since mathematics teachers have the highest quorum.

4.4.3.2 Language

Some teachers suggested that the platform needs to be in many languages, as well as to work on multiple networks (certain websites require a specific network, particularly in schools), and to be able to unblock some websites using the school network (e.g., Kahoot and Quizizz). Teacher (14) commented: *"The words and language used must be easy to understand and not very flashy. One has to get their concepts clear, so language matters a lot."*

4.4.4 Other Considerations

Teachers provided some other important factors that would help students improve their performance and motivation towards learning mathematics through using the self-learning platforms. Most teachers agreed on one concept, which is using only one single self-learning platform, in addition to the time factor.

4.4.4.1 Using a Single Platform

Majority of teachers indicated the importance of using one platform instead of using different platforms for students, as using more than one platform distracts students' focus. *"The self-learning platforms available today are great, but distractions can prevent the student from enjoying and continuing self-learning. The use of self-learning platforms has increased exponentially over the duration of COVID-19 pandemic, which is great, and I believe students will continue to benefit from these platforms for years to come."* (Teacher 6) Moreover, they stated that using a single platform is better if the platform is compatible with the curriculum.

4.4.4.2 Time

Time was a significant factor in terms of teachers' perceptions. *"Give students time to teach themselves concepts differently because some students prefer to learn slowly and explore different learning methods, helping them fully retain information."* (Teacher 15) Also, Teacher (17) suggested: *"Reducing school working hours so that there is time for the student to enter the platforms in the different subjects."*

4.4.5 Conclusion

The teachers' questionnaire main aim was to collect information about teachers' perceptions about the role of self-learning platforms in improving students' performance and increasing their motivation towards learning mathematics in cycle/3 schools affiliated with the Emirates Schools Establishment (ESE) in Abu Dhabi Emirate. The analysis of the teachers' questionnaire revealed the main factors influencing students' performance and motivation towards learning mathematics, that can be summarized as follows.

- The self-learning process allows students to be self-dependent as they can control the process as per their terms and areas of interest. They can control how they study, when to study, and if they want to repeat the lecture. Hence, this gives them a sense of independence and responsibility, in addition to self-confidence that they can manage the learning process on their own. Moreover, they can watch their own progress and manage to improve areas of weaknesses.

- Platform design has a significant role in improving students' level of learning and their motivation towards learning mathematics. The technology integrated into the platforms, such as learning games, rewarding systems, and communication systems increases students' desire to use the platform and learn more, which motivates them to learn mathematics, and hence enhances their acquired mathematical skills and learning level.

- Communication between the platform (teachers) and family, and between students and teachers is important to support students in their self-learning process.

- The diversity of resources students would have to use for self-learning is a crucial aspect of self-learning platforms. This includes a good, strong, easy to understand, and compatible content of the mathematics curriculum that students can grip easily and learn on their own. The availability of the content in different levels and different languages is important for all students' groups to be able to improve and develop their own skills.

- It is preferrable that students may use only a single platform that contains a suitable curriculum for their learning, so they avoid distraction.

- Finally, providing enough time for students to practice self-learning whether at school or after school working hours.

4.5 Triangulation of Findings

This section integrates all the results and summarizes the final results, based on the results of the analysis performed on the student's answer to the questionnaire and the teacher's answer to the open question. Triangulation in a study means answering research questions using multiple datasets, methods, theories, and / or researchers. This is a research program that helps researchers improve the validity and reliability of their research results (Bhandari, 2022b). In the current study, researchers used methodological triangulation. This is useful because it avoids the errors and biases associated with relying on a single research method by using mixed-method research that begins with conducting a quantitative survey (student survey), Followed by several (qualitative) structured interviews (eg, open teacher survey).

The analysis of both questionnaires indicated the great role of using self-learning platforms in improving students' performance in mathematics and motivating them towards learning mathematics. Students' questionnaire analysis results indicated significant differences between students' levels, in terms of the effect of using self-learning platforms on their performance and motivation. This was also indicated by teachers' opinions, that these platforms should have contents and materials that matches all levels of students and should be gradually organized from easy to difficult. Students showed high likelihood for using the platform before the class to do their homework and search for resources that may help them understand the new lesson;

this was in concordance with the suggestions of teachers that the platform should have more diverse resources for students to use. This is evidence that using self-learning platforms enhanced students to be more relying on themselves. Moreover, using these platforms improved students' engagement with their teacher during the class, as they were found to be highly demanding of understanding the new lesson by asking the teacher whenever they find something difficult to understand; in addition, they follow their teacher's instructions during the class. The same impact was found after class, as students were motivated to solve the assignments and homework their teacher gave them and do more exercises whenever the teacher asks to. Teachers find it very important to add new ways and tools for students to help them think more critically and enjoy the learning process on the platform, and also to help them practice more.

CHAPTER 5: Discussion

In this chapter, the researcher will try to discuss the results of the study that were obtained through the responses of the participating students who answered the questionnaire items related to getting to know their opinions about the role of self-learning platforms in raising the level of students' performance and their motivation towards learning mathematics. In addition to the opinions of the teachers participating in the study by answering the open-ended questions about self-learning platforms. The researcher also seeks in this chapter to compare the results of this study with previous studies conducted in the same field to obtain any concordances or differences in the results and their interpretation. On the other hand, this chapter will contain a set of recommendations for decision-makers regarding the development of a self-learning system for students using the educational platforms currently used in schools.

5.1 Discussion the result of the first research question

To what extent does the usage of self-learning platforms affect the performance of cycle/3 school students in mathematics in the Emirate of Abu Dhabi?

Through the results of the study shown by the analysis of the students' questionnaire, it was found that there is a high agreement rate by the cycle/3 students on the positive impact of self-learning platforms on their performance in mathematics, where the percentage reached 78.4%. Satisfaction reached its peak during the learning period during the classroom, reaching 80.8%, compared with 79% and 73.4% after the lesson and before the lesson, respectively. It appears from the previous results that the presence of the teacher during the student's self-learning increases the chance of developing his performance in mathematics because of the support that the teacher provides to his students directly during their learning, which is often represented by providing appropriate feedback to them about their performance in addition to guiding them and distributing roles to them. This is in great agreement with the findings of Masha et al. (2019) that improving the performance of learners has a positive relationship with the positive feedback provided to learners.

The students participating in the study expressed an agreement rate of 69.80% about the possibility of referring to the resources provided by the teacher through the self-learning platform before attending the classroom. This is a good percentage that gives an indication of the need to provide such resources for students in order to improve their performance in mathematics. This was confirmed by El-Senousy & Alquda (2017) about the impact of the flipped classroom strategy by providing resources for students on their results in post-tests compared to students who received a traditional education. Similarly, these results are consistent with Alyammahi (2020) findings that the Alef Education platform, a self-learning platform, positively affected the level of students' achievement and their interaction with scientific content.

On the other hand, the results of the study did not show any statistically significant differences between males and females about the level of their performance in mathematics, depending on the self-learning platforms. The average score for males was 3.89, compared to 3.96 for females. Similarly, the results did not show any statistically significant differences depending on the grade variable, as the average score for grade 10 was 3.98, compared with 3.88 for grader 12. As for the educational stream, the results showed that there were statistically significant differences between the students of the advanced stream and the general stream, where the average score of the students of the advanced stream was 4.05 compared with 3.76 among the students of the general stream. As for the achievement level variable, the results showed that there were statistically significant differences between the three groups <60, ≥60 to <80 and ≥80, where the mean scores were 3.30, 3.88, and 4.05, respectively. Here, it can be said that when the level of student achievement increases, the level of their performance increases using self-learning platforms.

With regard to analyzing the study data related to knowing the strength of the correlation between the study variables, the results showed a strong positive correlation between the results of the participants in the three time periods before class, during class and after class, based on the variables of gender, grade and stream. Where the value of the correlation coefficient ranged between 0.725 and 0.994. On the other

hand, the values of the correlation coefficient during the same periods, depending on the level variable, were strong positivity in the two categories greater than 80 and between 60 and 80, and medium positivity in the category less than 60, except for the after class period, where it was a weak positivity of 0.496.

Through the qualitative data collected, represented by the teachers' point of view participating in the study, the results confirmed the importance of self-learning platforms in developing students' performance in mathematics by giving them the ability to self-independence in education, where they can identify their strengths and weaknesses, work to develop them at any time and ability to watch the content many times. In the same context, Wang (2017) confirmed through his study on students at a university in Taiwan that students' self-evaluation and self-reflections while implementing problem-solving activities in the classroom positively affect their achievement. On the other hand, the participants stressed the need to adapt the mathematical content available on self-learning platforms for all levels of students, in addition to providing a constantly updated question bank.

5.2 Discussion the result of the second research question

To what extent does the usage of self-learning platforms affect students' motivation to learn mathematics in Cycle/3 schools in the Emirate of Abu Dhabi?

In terms of students' perceptions about the impact of self-learning platforms on their motivation to learn mathematics, the results showed a relative agreement value of 82.6%, and this indicates a high level of students' satisfaction with the effectiveness of these platforms and their ability to arouse their motivation towards learning mathematics. Among the tools available on self-learning platforms that encourage students to learn and increase their motivation is gamification through the availability of multiple types of electronic games. The students participating in the study expressed a high rate of agreement about the role of these games by increasing their motivation towards learning, which amounted to 80.40%. This is consistent with Fuster-Guilló (2019), who emphasized that the use of games in the classroom increases students'

motivation towards learning. Similarly, these results are consistent with the findings of Alyammahi (2017), that the Alef platform for education, which is an artificial intelligence platform that positively affected students' motivation towards learning.

The results did not show any statistically significant differences between males and females about the effect of self-learning platforms on motivation towards learning, as the average score for males was 4.09, compared to 4.19 for females. Similarly, there were no statistically significant differences between the grade 10 and grade 12 students, as the average scores of the grade 10 students reached 4.14 and the grade 12 students 4.15.

On the other hand, the results showed that there were statistically significant differences between students of the general stream and the advanced stream, where the average scores reached 3.94 and 4.28, respectively. Similarly, the results showed through the students' perceptions through the level variable that there were statistically significant differences between the three categories of less than 60, between 60 and 80 and greater than 80, reaching 3.51, 4.07 and 4.27, respectively. This indicates that self-learning platforms have a greater positive impact on students with a high level of achievement, and this effect is less on students with low level. The results also showed a strong positive correlation between the students' performance average in the three time periods (before class, during class and after class) and the average of motivation to learn, especially during class, where it reached 0.80.

As for the ability of self-learning platforms to increase students' motivation towards learning mathematics, the teachers participating in the study emphasized that these platforms contain a gamification system through which students can be evaluated, in addition to the possibility of effective communication between the teacher and student, and an attractive reward system for students. Therefore, there is great confidence from teachers in the possibility of increasing students' motivation towards learning mathematics, which is consistent with the quantitative results of the study, which confirmed that students have a relative agreement of 78.4%, which is considered a high agreement rate. These results are consistent with the findings of Dwijuliani et al.

(2021); Answer (2019) & Fuster-Guilló (2019) on the importance of the role of the teacher and the use of gamification in motivating students to learn while students are in self-learning process.

The results of the study show that the self-learning platforms currently used in the cycle/3 schools in the Emirate of Abu Dhabi play an important role in improving students' performance in mathematics and greatly motivate them to learn it. In particular, the results showed a greater effectiveness of these platforms during in-class learning compared to learning before class as well as after class. The qualitative results of the study, through the opinions of the teachers participating in the study, also confirmed the development of the current platforms to become more suitable for all levels of students, with the need to focus on using only one platform for self-learning instead of distracting the student with more than one educational platform.

CHAPTER 6: Conclusion & Recommendations

6.1 Conclusion

This study confirmed the importance of the self-learning platforms used in the cycle/3 schools in the Emirate of Abu Dhabi on students' performance in mathematics and increasing their motivation towards learning mathematics through these platforms. The students participating in the study showed a high satisfaction rate in many aspects, and the satisfaction rate varied in terms of the educational stream (advanced - general) as well as in terms of the level of achievement (less than 60 - 60 to 80 - greater than 80), where the results showed that Students of the advanced stream have more confidence than students of the general stream in these educational platforms. In addition, the results did not show clear differences in the level of satisfaction depending on the variable of gender or grade. On the other hand, students of the category less than 60 were the least confident in their ability to learn on their own through these platforms.

As for the teachers participating in the study, they emphasized the great role of these platforms in student learning and increasing their motivation in terms of containing several advantages, most notably:

‒ The possibility of the student's access to learning resources at any time.

‒ The ability to view the content more than once.

‒ Provides rewards systems for students, such as badges and medals.

6.2 Recommendations

Based on the finding of this study, the researcher provides several recommendations regarding the development of the self-learning system in the schools of the Emirates of Abu Dhabi. These recommendations can be useful as a step the right direction with the help of further studies on the same subject.

First, diversification of the evaluation tools available on the platforms. Variety of assessment methods, in this sense, facilitates a more inclusive approach to assessment design. By this way students will be able to express their learning in a variety of ways,

lowering the risk that anyone will be disadvantaged by the widespread use of a single type of assessment.

Moreover, it is also recommended to find a single platform in which students can study, without being distracted by an overabundance of platforms. As long as the aim of assessment can be achieved by a single platform, then why we tend to use more. This will lead to overload on students and as a result, students will get bord and they may use none of these platforms. We must keep in mind that secondary school students have a lot of responsibilities to fulfill during the school year.

Finally, developing teachers' abilities that related to online teaching and assessment in appropriate teaching strategies. This will improve students' self-learning preparation to use accessible learning platforms such as Alef Learning Platform, the most widely used platform in the cycle / 3 schools in the Emirate of Abu Dhabi.

6.3 Limitations

In order to apply the tools of this study to the students of the cycle /3 schools in the Emirate of Abu Dhabi, some of whom are less than 16 years old, this study was considered to be of medium risk, and accordingly, the researcher obtained the approval of research ethics from the competent authority at the British University in Dubai. Based on this approval, the researcher obtained the approval from ESE to implement the study tools within the selected schools. In order to protect the rights of the participants, the researcher pledged to the participants to maintain the confidentiality of their data, conceal their identity, and not use their responses except for the requirements of this research only.

Since the use of educational platforms in the schools of the Emirate of Abu Dhabi did not exist for a long time, many studies are not available that have examined the impact of these platforms on student learning, especially with regard to self-learning through these platforms. So, the researcher tried through this study to identify the impact of these Platforms on students' performance and motivation towards learning mathematics. However, there are many areas that must be covered in future research on the same topic, as the researcher advises expanding the scope of the research to

include all subjects as languages and science. In addition to expanding the study sample to include a larger number of schools and from different geographical areas within the Emirate of Abu Dhabi.

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appendices

Appendix 1: Histograms of Composite Variables
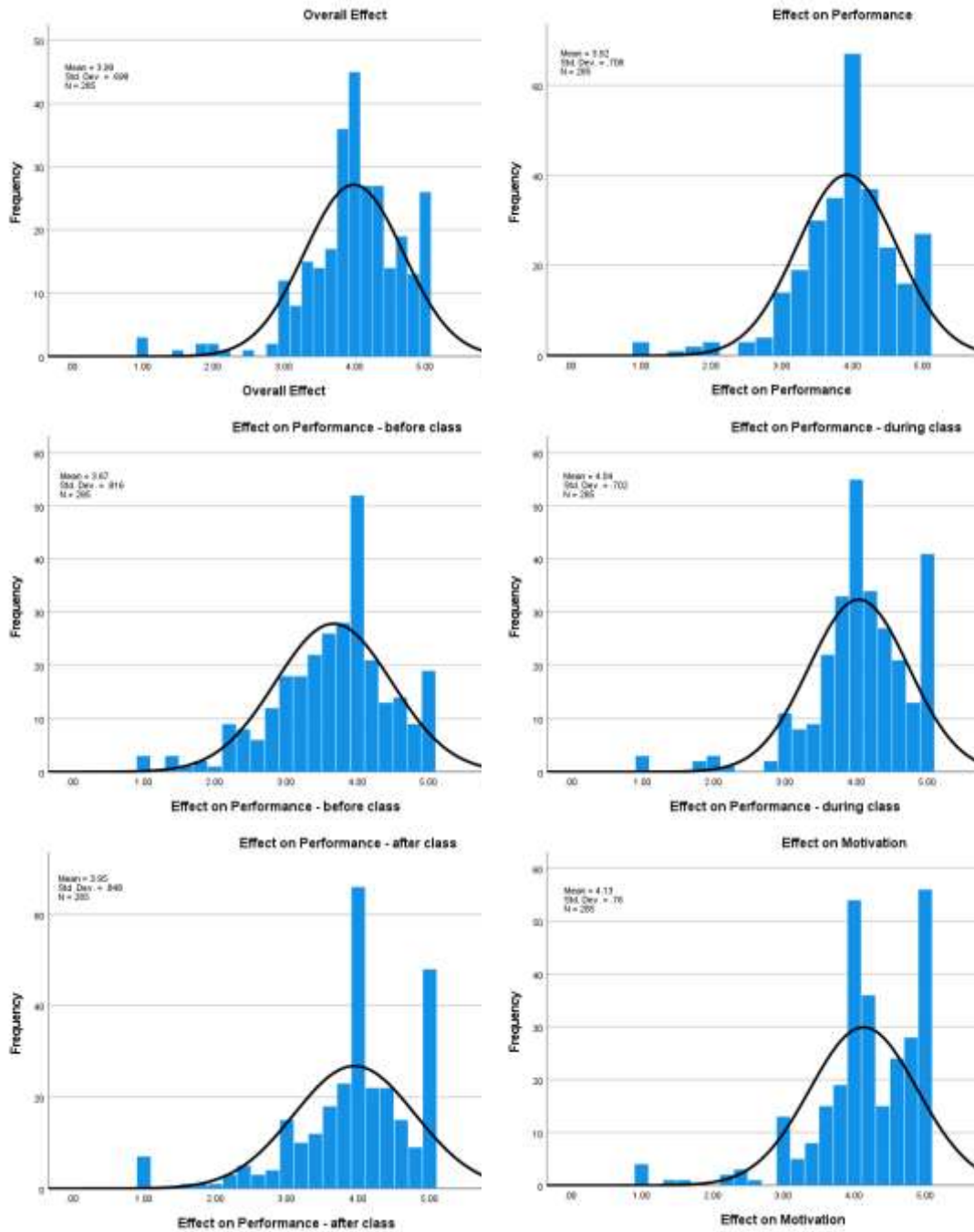
Appendix 2: Post Hoc Tests

Multiple Comparisons
Tukey HSD

Dependent Variable	(I) Level	(J) Level	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Overall Effect	<60	>=60 to <80	-.57705*	.14664	<.001	-.9225	-.2316
		>=80	-.75595*	.14091	<.001	-1.0880	-.4239
	>=60 to <80	<60	.57705*	.14664	<.001	.2316	.9225
		>=80	-.17890	.08501	.091	-.3792	.0214
	>=80	<60	.75595*	.14091	<.001	.4239	1.0880
		>=60 to <80	.17890	.08501	.091	-.0214	.3792
Effect on Performance	<60	>=60 to <80	-.58485*	.14917	<.001	-.9363	-.2334
		>=80	-.75479*	.14334	<.001	-1.0925	-.4171
	>=60 to <80	<60	.58485*	.14917	<.001	.2334	.9363
		>=80	-.16994	.08648	.123	-.3737	.0338
	>=80	<60	.75479*	.14334	<.001	.4171	1.0925
		>=60 to <80	.16994	.08648	.123	-.0338	.3737
Effect on Performance - Before Class	<60	>=60 to <80	-.81815*	.17058	<.001	-1.2201	-.4162
		>=80	-.94238*	.16392	<.001	-1.3286	-.5562
	>=60 to <80	<60	.81815*	.17058	<.001	.4162	1.2201
		>=80	-.12423	.09890	.421	-.3572	.1088
	>=80	<60	.94238*	.16392	<.001	.5562	1.3286
		>=60 to <80	.12423	.09890	.421	-.1088	.3572
Effect on Performance - During Class	<60	>=60 to <80	-.49823*	.14882	.003	-.8489	-.1476
		>=80	-.68401*	.14300	<.001	-1.0210	-.3471
	>=60 to <80	<60	.49823*	.14882	.003	.1476	.8489
		>=80	-.18578	.08628	.081	-.3891	.0175
	>=80	<60	.68401*	.14300	<.001	.3471	1.0210
		>=60 to <80	.18578	.08628	.081	-.0175	.3891
Effect on Performance - After Class	<60	>=60 to <80	-.52477*	.18184	.012	-.9532	-.0963
		>=80	-.70876*	.17474	<.001	-1.1205	-.2970
	>=60 to <80	<60	.52477*	.18184	.012	.0963	.9532
		>=80	-.18399	.10542	.190	-.4324	.0644
	>=80	<60	.70876*	.17474	<.001	.2970	1.1205
		>=60 to <80	.18399	.10542	.190	-.0644	.4324
Effect on Motivation	<60	>=60 to <80	-.56146*	.16088	.002	-.9405	-.1824
		>=80	-.75827*	.15460	<.001	-1.1225	-.3940
	>=60 to <80	<60	.56146*	.16088	.002	.1824	.9405
		>=80	-.19681	.09328	.090	-.4166	.0230
	>=80	<60	.75827*	.15460	<.001	.3940	1.1225
		>=60 to <80	.19681	.09328	.090	-.0230	.4166

*. The mean difference is significant at the 0.05 level.

Appendix 3: Students Questionnaire

A survey about the effect of using self-learning platforms on students learning

Dear students,

I have invited you to fill out the following online survey. The purpose of this survey is to find out the perceptions of the students about the effect of using self-learning platforms on students performance and motivations toward learning mathematics.

Also, please be assured that the answers that you provide would be kept in the strictest confidentiality and anonymity would be maintained throughout. Your participation is voluntary and you have the right to withdraw from the study at any time.

By completing this questionnaire, you consent participate in the following survey activity and you understand that the data collected will be used for educational research purposes only.

Thank you for your support.

Scholar name: Raed Alnusairat
Scholar email: 20000237@student.buid.ac.ae
(mailto:20000237@student.buid.ac.ae)
Supervisor name: Pro. Christopher Hill
Supervisor email: christopher.hill@buid.ac.ae
(mailto:christopher.hill@buid.ac.ae)

* Required

1. Do you want to participate in this study? هل ترغب بالمشاركة في هذا الدراسة ؟ 1.

○ Yes

○ No

Personal information's

2. Choose your gender? اختر الجنس *

- ○ ذكر /Male

- ○ أنثى / Female

3. Choose your grade?   اختر صفك الدراسي *

- ○ Grade 10

- ○ Grade 12

4. Choose your stream?   اختر مسارك التعليمي *

- ○ Advanced

- ○ General

5. Choose your achievement level in mathematics? اختر مستوى تحصيلك في الرياضيات؟ *

- ○ أكبر من أو يساوي 80 (grater than or equal 80)

- ○ أكبر من أو يساوي 60 و أقل من 80 (greater than or equal 60 and less than 80)

- ○ أقل من 60 (less than 60)

The effect of using self-learning platforms on the students performance.

6. Question *

	Strongly disagree غير موافق بشدة	disagree غير موافق	Neutral محايد	Agree موافق	Strongly agree موافق بشدة
I return to the self-learning platforms to review the previous lesson before starting the new lesson. أقوم بالرجوع لمنصات التعلم الذاتي لمراجعة الدرس السابق قبل البدء بالدرس الجديد	○	○	○	○	○

7. Question *

	Strongly disagree غير موافق بشدة	disagree غير موافق	Neutral محايد	Agree موافق	Strongly agree موافق بشدة
I do my homework using self-learning platforms at home before coming to school. أحل الواجبات المطلوبة مني باستخدام منصات التعلم الذاتي في البيت قبل الحضور للمدرسة.	○	○	○	○	○

8. Question *

	Strongly disagree غير موافق بشدة	disagree غير موافق	Neutral محايد	Agree موافق	Strongly agree موافق بشدة
I look into the material required for the new lesson through self-learning platforms before attending class. أقوم بالاطلاع على المادة المطلوبة للدرس الجديد من خلال منصات التعلم الذاتي قبل الحضور للصف.	○	○	○	○	○

9. Question *

	Strongly disagree غير موافق بشدة	disagree غير موافق	Neutral محايد	Agree موافق	Strongly agree موافق بشدة
I look for some additional resources that will help me understand new lesson content through self-learning platforms. أبحث عن بعض المصادر الإضافية التي تساعدني في فهم محتوى الدرس الجديد من خلال منصات التعلم الذاتي.	○	○	○	○	○

10. Question *

	Strongly disagree غير موافق بشدة	disagree غير موافق	Neutral محايد	Agree موافق	Strongly agree موافق بشدة
I create questions related to the new lesson so that I can discuss them in class with my classmates. أقوم بوضع تساؤلات متعلقة بالدرس الجديد حتى أناقشها داخل الصف مع زملائي.	○	○	○	○	○

11. Question *

	Strongly disagree غير موافق بشدة	disagree غير موافق	Neutral محايد	Agree موافق	Strongly agree موافق بشدة
During the class, I follow the teacher's explanation for the lesson topic using the self-learning platform. أتابع شرح المعلم لموضوع الدرس من خلال منصة التعلم الذاتي خلال الحصة.	○	○	○	○	○

75

12. Question *

	Strongly disagree غير موافق بشدة	disagree غير موافق	Neutral محايد	Agree موافق	Strongly agree موافق بشدة
I carry out the instructions given by the teacher during the class. أقوم بتنفيذ التعليمات المعطاة من قبل المعلم أثناء الحصة.	○	○	○	○	○

13. Question *

	Strongly disagree غير موافق بشدة	disagree غير موافق	Neutral محايد	Agree موافق	Strongly agree موافق بشدة
I participate in individual and group activities through the self-learning platform during the class. أقوم بالمشاركة في الأنشطة الفردية والجماعية من خلال منصة التعلم الذاتي خلال الحصة.	○	○	○	○	○

14. Question *

	Strongly disagree غير موافق بشدة	disagree غير موافق	Neutral محايد	Agree موافق	Strongly agree موافق بشدة
I ask the teacher when I find it difficult to understand the solution. أقوم بطرح الأسئلة على المعلم عندما أجد صعوبة في فهم الحل.	○	○	○	○	○

15. Question *

	Strongly disagree غير موافق بشدة	disagree غير موافق	Neutral محايد	Agree موافق	Strongly agree موافق بشدة
I make sure to complete the tasks required by the teacher on the self-learning platform during the lesson. أحرص على الانتهاء من المهام المطلوبة من قبل المعلم على منصة التعلم الذاتي خلال الحصة.	○	○	○	○	○

77

16. Question *

	Strongly disagree غير موافق بشدة	disagree غير موافق	Neutral محايد	Agree موافق	Strongly agree موافق بشدة
I discuss with my classmates the strategies for solving the required tasks before starting to implement them on the self-learning platform. أناقش زملائي بالصف باستراتيجيات حل المهام المطلوبة قبل البدء بتنفيذها على منصة التعلم الذاتي.	○	○	○	○	○

17. Question *

	Strongly disagree غير موافق بشدة	disagree غير موافق	Neutral محايد	Agree موافق	Strongly agree موافق بشدة
I am keen on documenting my work through the self-learning platform in the classroom for future use. أحرص على توثيق عملي من خلال منصة التعلم الذاتي داخل الحصة الصفية من أجل استخدامه مستقبلاً.	○	○	○	○	○

18. Question *

	Strongly disagree غير موافق بشدة	disagree غير موافق	Neutral محايد	Agree موافق	Strongly agree موافق بشدة
I am keen on getting feedback from the teacher about the tasks that I carry out on the self-learning platform during the class session. أحرص على الحصول على تغذية راجعة من المعلم حول المهام التي أنفذها على منصة التعلم الذاتي خلال الحصة الصفية	○	○	○	○	○

19. Question *

	Strongly disagree غير موافق بشدة	disagree غير موافق	Neutral محايد	Agree موافق	Strongly agree موافق بشدة
I change the answering steps used when executing tasks on the self-learning platform in case I did not succeed in solving them the first time. أغير من استراتيجية الحل المتبعة عن تنفيذ المهام على منصة التعلم الذاتي في حال لم أنجح من المرة الأولى قد جاءا	○	○	○	○	○

20. Question *

	Strongly disagree غير موافق بشدة	disagree غير موافق	Neutral محايد	Agree موافق	Strongly agree موافق بشدة
I use the resources available on the self-learning platform during the session to better understand the content. أقوم باستخدام المصادر المتاحة لي على منصة التعلم الذاتي خلال الحصة لفهم المحتوى بشكل أفضل	○	○	○	○	○

21. Question *

	Strongly disagree غير موافق بشدة	disagree غير موافق	Neutral محايد	Agree موافق	Strongly agree موافق بشدة
I review the lesson at home after returning from school through the self-learning platform. (1) أقوم بمراجعة الدرس في البيت بعد العودة من المدرسة من خلال منصة التعلم الذاتي	○	○	○	○	○

22. Question *

	Strongly disagree غير موافق بشدة	disagree غير موافق	Neutral محايد	Agree موافق	Strongly agree موافق بشدة
I do the required assignments on the self-learning platform at home. أقوم بحل الواجبات المطلوبة مني على منصة التعلم الذاتي في البيت	○	○	○	○	○

23. *

	Strongly disagree غير موافق بشدة	disagree غير موافق	Neutral محايد	Agree موافق	Strongly agree موافق بشدة
I use the resources available to me on the self-learning platform when needed at home. أستعين بالمصادر المتاحة لي على منصة التعلم الذاتي عند الحاجة في البيت	○	○	○	○	○

24. *

	Strongly disagree غير موافق بشدة	disagree غير موافق	Neutral محايد	Agree موافق	Strongly agree موافق بشدة
I review the new lesson content on the self-learning platform after returning from school. أقوم بالاطلاع على محتوى الدرس الجديد على منصة التعلم الذاتي بعد العودة من المدرسة	○	○	○	○	○

25. *

	Strongly disagree غير موافق بشدة	disagree غير موافق	Neutral محايد	Agree موافق	Strongly agree موافق بشدة
I make sure to solve the additional activities and tasks that the teacher provides me with on the self-learning platform after returning from school. أحرص على حل الأنشطة والمهام الإضافية التي يوفرها لي المعلم على منصة التعلم الذاتي بعد العودة من المدرسة	○	○	○	○	○

The effect of using self-learning platforms on students'

26. Question *

	Strongly disagree غير موافق بشدة	disagree غير موافق	Neutral محايد	Agree موافق	Strongly agree موافق بشدة
I do my best to pay attention to the teacher's explanation in order to understand the lesson. أبذل قصارى جهدي في الانتباه لشرح المعلم من أجل فهم الدرس	○	○	○	○	○

27. Question *

	Strongly disagree غير موافق بشدة	disagree غير موافق	Neutral محايد	Agree موافق	Strongly agree موافق بشدة
I feel strongly motivated towards learning mathematics through the self-learning platform. أشعر بدافع قوي نحو تعلم الرياضيات من خلال منصة التعلم الذاتي.	○	○	○	○	○

28. Question *

	Strongly disagree غير موافق بشدة	disagree غير موافق	Neutral محايد	Agree موافق	Strongly agree موافق بشدة
I make sure to attend math class on time. أحرص على الحضور لحصة الرياضيات في الوقت المحدد	○	○	○	○	○

29. Question *

	Strongly disagree غير موافق بشدة	disagree غير موافق	Neutral محايد	Agree موافق	Strongly agree موافق بشدة
I strive to achieve the required learning objectives through the self-learning platform. أحرص على تحقيق أهداف التعلم المطلوبة من خلال منصة التعلم الذاتي	○	○	○	○	○

30. Question *

	Strongly disagree غير موافق بشدة	disagree غير موافق	Neutral محايد	Agree موافق	Strongly agree موافق بشدة
I make sure to win competitions conducted by the teacher through the self-learning platform during the class. أحرص على الفوز بالمسابقات التي يجريها المعلم من خلال منصة التعلم الذاتي خلال الحصة	○	○	○	○	○

31. Question *

	Strongly disagree غير موافق بشدة	disagree غير موافق	Neutral محايد	Agree موافق	Strongly agree موافق بشدة
I make sure to get the badges available on the self-learning platform from the teacher. أحرص على الحصول على الأوسمة المتاحة على منصة التعلم الذاتي من المعلم	○	○	○	○	○

85

32. Question *

	Strongly disagree غير موافق بشدة	disagree غير موافق	Neutral محايد	Agree موافق	Strongly agree موافق بشدة
I take the initiative to help my classmates during group activities on the self-learning platform. أبادر إلى مساعدة زملائي خلال الأنشطة الجماعية على منصة التعلم الذاتي	○	○	○	○	○

33. Question *

	Strongly disagree غير موافق بشدة	disagree غير موافق	Neutral محايد	Agree موافق	Strongly agree موافق بشدة
I make sure to use the learning resources available on the self-learning platform when facing difficult questions. أحرص على الاستعانة بمصادر التعلم المتوفرة على منصة التعلم الذاتي عند مواجهة أسئلة صعبة	○	○	○	○	○

34. Question *

	Strongly disagree غير موافق بشدة	disagree غير موافق	Neutral محايد	Agree موافق	Strongly agree موافق بشدة
Through the self-learning platform, I get resources for learning that are compatible with my personal abilities. أحصل من خلال منصة التعلم الذاتي على مصادر للتعلم تتناسب مع قدراتي الشخصية.	○	○	○	○	○

35. Question *

	Strongly disagree غير موافق بشدة	disagree غير موافق	Neutral محايد	Agree موافق	Strongly agree موافق بشدة
I do my best to get high scores in Mathematics by learning via the self-learning platform. أبذل قصارى جهدي للحصول على درجات مرتفعة في الرياضيات من خلال التعلم عبر منصة التعلم الذاتي	○	○	○	○	○

87

Appendix 4: Teachers Questionnaire

teachers/ A survey about the effect of using self-learning platforms on students learning ⅋

Dear teachers,

I have invited you to fill out the following online survey. The purpose of this survey is to find out the perceptions of the teachers about the effect of using self-learning platforms on students performance and motivations toward learning mathematics.

Also, please be assured that the answers that you provide would be kept in the strictest confidentiality and anonymity would be maintained throughout. Your participation is voluntary and you have the right to withdraw from the study at any time.

By completing this questionnaire, you consent participate in the following survey activity and you understand that the data collected will be used for educational research purposes only.

Thank you for your support.

Scholar name: Raed Alnusairat
Scholar email: 20000237@student.buid.ac.ae
Supervisor name: Pro. Christopher Hill
Supervisor email: christopher.hill@buid.ac.ae

1. Do you want to participate in this study?   هل ترغب بالمشاركة في هذا الدراسة ؟
*

○ Yes

○ No

2. من وجهة نظرك كيف يمكن أن تلعب منصات التعلم الذاتي دورا مهما في تحسين أداء الطلبة في مادة الرياضيات؟

From your point of view, how can self-learning platforms play an important role in improving students' performance in mathematics? *

3. من وجهة نظرك كيف يمكن أن تلعب منصات التعلم الذاتي دورا مهما في تحسين دافعية الطلبة نحو تعلم مادة الرياضيات؟

From your point of view, how can self-learning platforms play an important role in improving students' motivation towards learning mathematics? *

4. من وجهة نظرك ما هي احتياجات منصات التعلم الذاتي المستخدمة حاليا لتصبح أكثر فاعلية في تعزيز التعلم الذاتي لدى الطلبة في مادة الرياضيات؟

From your point of view, what are the needs of the self-learning platforms currently used to become more effective in promoting self-learning for students in mathematics? *

5. اكتب أي ملاحظات أو اقتراحات حول الموضوع ترغب بإضافتها.

Write any comments or suggestions about the topic that you would like to add.

Appendix 5: Letter From BUID to ESE about Ethics Form approval

23 March 2022

To Whom It May Concern

This is to certify that Mr. Raed Hamad Alnusairat with Student ID number 20000237 has been a student on the Master of Education in Information and Communication Technology programme at The British University in Dubai since September 2020.

Mr. Raed Hamad Alnusairat has successfully completed the taught stage of the programme. He is currently working on his thesis titled "The impact of the use of self-learning platforms on students' performance and motivating them to learn mathematics in Cycle/3 schools in the Emirate of Abu Dhabi". His Ethics Form for the mentioned thesis title has been approved.

Your permission for him to conduct his research in your organisation is hereby requested. Any support provided to him in this regard will be highly appreciated.

This letter is issued at Mr. Alnusairat's request.

Yours sincerely,

Dr. Amer Alaya
Head of Student Administration
The British University in Dubai

Appendix 6: Letter From BUID to ESE

The British University in Dubai
الجامعة البريطانية في دبي
www.buid.ac.ae

18 February 2022

To Whom It May Concern

This is to certify that Mr. Raed Hamad Alnusairat with Student ID number 20000237 has been a student on the Master of Education in Information and Communication Technology programme at The British University in Dubai since September 2020.

Mr. Alnusairat has successfully completed the taught stage of the programme. He is currently working on his research titled "The impact of using self-learning platforms on students' performance and motivating them to learn mathematics in Cycle/3 schools in the Emirate of Abu Dhabi". He is required to gather data through surveys.

Your permission for him to conduct his research in your organisation is hereby requested. Any support provided to him in this regard will be highly appreciated.

This letter is issued at Mr. Alnusairat's request

Yours sincerely,

Dr. Amer Alaya
Head of Student Administration
The British University in Dubai

Appendix 7: Approval Letter from ESE

Faciliitating a researcher's study from BUID	تسهيل مهمة الباحثين من جامعة دبي
Dear School leaders, The researcher Raed Hamad Alnusairat is completing her postgraduate studies for a master's degree from BUID university. The researcher is currently collecting data for his final research dissertation entitled, "The impact of the use of self-learning platforms on students' performance and motivating them to learn mathematics in Cycle/3 schools in the Emirate of Abu Dhabi." This questionnaire will not ask you to write your name or school name as participants are meant to be anonymous. All information will be kept confidential as well as it will be used for scientific research and development purposes only. Your consent will be presumed when you submit response to the questionnaire. Therefore, we invite all targeted teachers in the schools below to participate in this research project by completing the survey. Kindly share your experiences and point of views by completing the following survey: https://bit.ly/3ftLnSE Thank you in anticipation for your intended support! Kind Regards	السادة مدراء المدارس الحكومية المحترمين يقوم الباحث رائد حمد النصيرات باستكمال الدراسة العليا للحصول على درجة الماجستير من جامعة دبي حيث إن الباحثة حالياً بصدد جمع البيانات للأطروحة البحثية النهائية للبحث بعنوان: " أثر استخدام منصات التعلم الذاتي على أداء الطلاب وتحفيزهم على تعلم الرياضيات في الحلقة / 3 مدارس بإمارة أبوظبي" وعليه ندعو جميع المعلمين في المدارس المستهدفة أدناه للمشاركة في هذا البحث لدعم الباحث، علما بان لن يتطلب كتابة اسمك أو اسم مدرستك في الاستبانة فالمشاركة مجهولة وجميع إجاباتكم ستكون سرية وستضيف قيمة إلى نتائج هذا البحث الذي سيتم استخدامه لأغراض البحث العلمي والتطوير الأكاديمي. سيتم اعتماد موافقتك بالمشاركة في الدراسة عند تقديم الاجابات على أسئلة الاستبانة، وستشكل إجاباتكم داعما أساسيا في فهمنا للوضع الراهن الخاص بالدراسة ومشاركتكم تهمنا أيضاً للوصول إلى نتائج دقيقة وواضحة وذلك بالمشاركة في الاستبانة من خلال الرابط التالي: https://bit.ly/3ftLnSE شكرا لك على وقتكم وتعاونكم،،