Ninth International Conference
Education, Language Instruction and Technology –
ELIT-2023

The impact of E-learning mathematics in higher Education, Israel

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Abstract

The main aim of this study is to implement e-learning, especially in programs of study in mathematical education. Qualitative and non-random data were collected from high school, college, and university students in Israel using survey methods. There are two types of evidence, the outcomes of learning mathematics, and the students' responses using an online questionnaire. The survey was used to determine their answers. It is a qualitative case study, supported by a web-based survey. Data were gathered through an online survey with 15 questions. The survey was conducted with various age groups of pupils pursuing studies in different schools, colleges, or universities in Israel during this lockdown period due to the COVID-19 disaster to evaluate the challenges in e-learning that exist in Israel. Based on the survey of various websites, the benefits and difficulties linked with using websites in learning math are outlined. Keywords: e-learning, mathematics, Israeli students

Introduction

Mathematics is a subject taught in secondary schools and universities. It is one of the fundamental components of education, requiring students to possess the capability to understand and apply various methods for structuring their lives. For instance, in late 2019, the world witnessed a significant upheaval with the emergence of the coronavirus in Wuhan, China, which subsequently spread to several countries worldwide. The rapid spread of the virus affected nearly every country, including Israel, within a matter of months. Consequently, several nations implemented containment policies to curb the virus's spread [1; 2]. Numerous policies were put in place by educational institutions to ensure the continuity of learning. One of the most relevant approaches to learning during the COVID-19 pandemic is the use of remote learning methods [3; 4]. However, implementing remote learning is not a straightforward task, as it requires preparation from both educators and students, as well as educational institutions [5]. Regarding home-based learning, the Minister of Education and Culture emphasizes the necessity of conducting it through online or distance learning methods, with the aim of providing students with meaningful educational experiences without overwhelming them with the pressure of completing all course requirements for grade promotion. The Minister of Education and Culture also commends regions that have adopted home-based learning and ensures that educators also work from home to prioritize their safety [6].

E-learning is a form of education delivered through the Internet, constituting a type of distance learning that occurs outside a traditional classroom setting. The primary motivation behind this approach lies in its ability to provide students with increased access to education when compared to traditional teaching methods. This accessibility allows students to commence their studies from virtually anywhere and at any time [7]. Salamat et al. [8] further explain that online learning involves communication between students and teachers through digital platforms. Students can receive instruction through online systems, even when teachers are physically distant from them.

The prevalence of e-learning has grown significantly due to its capacity to offer flexibility in learning, enabling unrestricted access to educational materials and the ability to study at one's own pace and convenience [8]. Online learning offers numerous advantages, including heightened motivation, expanded educational opportunities, improved student learning skills, access to high-quality learning resources, enhanced educational outcomes, and efficiency in educational management. Additionally, e-learning provides students with flexible features, granting them access to reliable learning materials and fostering independent learning skills [9]. Moreover, online learning environments can nurture personal relationships, social skills, and interactions among participants [10]. Nonetheless, it is crucial to recognize that while e-learning can be a valuable solution during school closures, it does not replace the importance of face-to-face communication between students and educators [11].

It is understood that learning technology represents an innovative educational approach that can be implemented using telecommunication systems, facilitating interactive communication between teachers and students. The term 'e-learning' is relatively new within the Israeli education sector and introduces several innovations related to modern data and communication technologies applied in education, including innovative software, communication media, broadband connectivity, and more [12; 13].

However, e-learning may not be suitable for everyone, as it differs significantly from traditional classroom-based learning. Online learning is particularly favored by students who are unable to attend regular classes at schools or colleges for various reasons. Presently, many educational institutions worldwide have been forced to close due to the global COVID-19 pandemic. While numerous countries have transitioned to online teaching, students in urban areas with reliable internet access tend to benefit the most. In contrast, students in remote rural areas face challenges and may struggle to participate in online classes due to various factors, including the lack of necessary infrastructure for e-learning. This has presented both teachers and students with unexpected challenges and crises.

Sande [14] conducted a study examining how students engage in online discussions related to mathematics. The objective of the research was to characterize students' mathematical interactions when posing questions and responding to support provided. The study analyzed 100 queries and responses related to the concept of the boundary of a step-by-step function, as well as 100 queries and responses related to the application of derivatives. The findings revealed that a significant portion of students actively formulated questions, indicating their willingness to express their ideas. The second-largest group consisted of students who did not demonstrate much mathematical activity in their queries; these were primarily students seeking immediate assistance due to their limited understanding of the topic. Interestingly, when assistance was provided through further questioning, these students became more engaged and began to explore their own ideas. This highlights the connection between student activity and the type of support provided, prompting a search for factors that influence student engagement.

Mulenga & Marban [15] described digital learning in math. Data were collected from 102 mathematical professors at Copperbelt University. The results demonstrate the positive reaction of e-learning during the COVID-19 closing period. This study revealed their wish to create an official online virtual platform for math students via the university. Owusu-Fordjour et al., [16] studied the impact of COVID-19 and the challenges facing Ghanaian students. They talked about the capacity of parents to access technology. They examined the disadvantages of the online educational system.

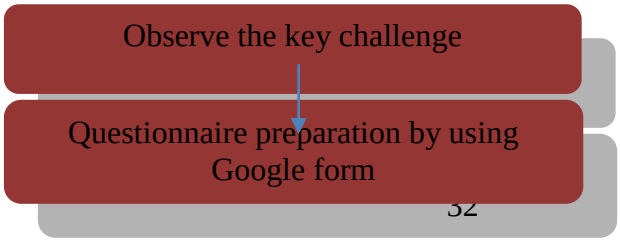
Baki [17] observed on the use of Web sites to elucidate the function concept and practical problems solved in high schools for 5 weeks. The researcher studied how students changed their attitudes towards the educations and their outcomes. Each contributing school had students separated into investigational and control groups. Preliminary analysis revealed no variances between the 2 groups with respect to their initial information. The survey group operated with websites during their lessons twice per week and the students also used them for their work at house. Whereas the research is still ongoing, the educators listed an augmented inspiration and confidence in the students in terms of education and accomplishing tasks. The post-test information and ability, the investigational group exhibited suggestively better outcomes, in particular in amended understanding of the different illustrations of functions. Educators positively assessed the communicating essentials of the site and reported that the concept of visualization and animatronics played a vital role in educating students.

This study analysed how e-learning mathematics helped various age groups during the COVID-19 pandemic. How have a variety of online learning platforms been used to effectively interact with teachers and students? The study also analysed the views expressed by on-line students.

Methodology

The qualitative method was employed to assess the influence of online mathematics learning among students at the Upper Secondary School, College, and University levels in Israel. The research sample consisted of two secondary schools, two colleges, and one university student in Israel, selected through a non-random sampling method. The focus of this study encompassed 200 students studying mathematics education.

Data for this study were collected using online surveys and interviews. A total of 15 questions were incorporated into the online survey to gauge the impact of e-learning on mathematics for students. Google Forms was utilized as the platform for online surveys, while Google Meet was employed for conducting online interviews.



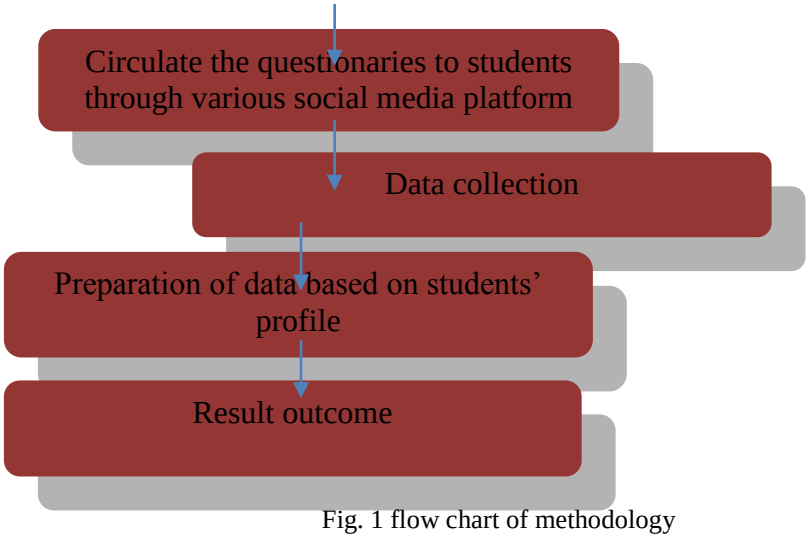


Fig. 1 flow chart of methodology

Results and Discussion

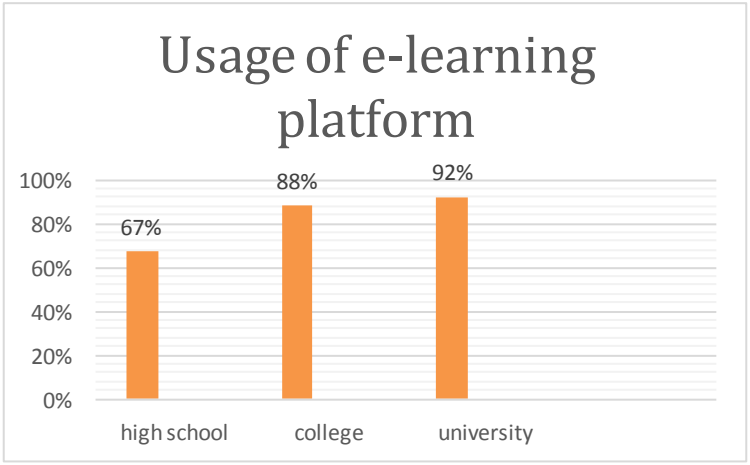
As a result of the COVID-19 pandemic, teachers and students can no longer meet in traditional classrooms, necessitating the transition to distance learning. E-learning emerged as the primary solution to continue education during the pandemic due to its various advantages. However, despite its convenience, teachers have had to swiftly adapt to a range of online teaching methods, which has posed challenges for them. Several factors, including those related to students, teachers, schools, curricula, and parents, have contributed to these challenges [18; 19; 20].

Graph 1 illustrates the usage of electronic learning platforms by students, indicating that 92% of university students utilized various online learning platforms, followed by college and high school students. The extent of e-learning adoption was influenced by self-efficacy, while intentions to continue using e-learning systems were predicted by factors such as social influence (SI), effort expectancy (EE), and performance expectations (PE).

The advent of e-learning technologies has led to a significant increase in the utilization of e-learning systems to enhance university education by offering a blend of in-class teaching, online learning, and distance education methods [21].

The results obtained from an online examination indicate that learning management platforms are widely utilized, with Google Classroom being the most commonly used option. Audio-visual conferencing, represented by Zoom, comes as the second choice (see Figure 1). Both Email and Webex were utilized by a smaller number of learners.

When it comes to learning mathematics through lectures and topics, Zoom, Google Meet, and Google Classroom are the preferred platforms. Additionally, YouTube and WhatsApp have also been used frequently, with a usage rate of 16%



Graph. 1 The usage of e-learning platform by students

The selection of eLearning media frequency was based on several considerations. The most significant factor taken into account was the practicality of the platform. It had to be user-friendly, easily accessible, free, quick to use, available at all times, and efficient in organizing materials and practice-related issues. These advantages have sustained the functionality of online educational technology, enhancing the teaching and learning experience, facilitating lesson sharing, content creation, assessment, and feedback [11].

Another reason for choosing a particular platform to support e-learning was that students were already familiar with and had access to that platform. Lastly, the school administration's orientation and approval influenced the choice of an e-learning platform, which resulted in a lower percentage of selection.

Table. 2 Difficulties faced by students though learning online math

Difficulties faced by students	No. of students participated	Percentage
Unable to connect with my peer group	67	27%
Unable to integrate with the group of other students	55	22%
Can't keep up with the speed of every other student	49	20%
Online software tools selected for math which I do not know	66	26%
I need more training on the software tool prior to learning	97	39%
High quality camera signal failure due to low internet signal	87	35%
No, I haven't faced any of those difficulties that I'm aware of software	53	

Some results did not match our estimates. We believed that no straight interaction with educators would be considered the main difficulty and, ultimately, the students' votes put it in tertiary position (Table. 1). For pupils, the main drawback of electronic learning would be a lack of communication with their colleagues. Overall, lack of direct interaction is considered the biggest issue in online learning. The fact that working long hours on the computer may be detrimental is the major drawback. Its demonstrates that pupils are committed to the protection of their strength and the atmosphere. Students admit the Internet and the computer as a means of learning, of getting information, of interacting with one another, but the students distinguish that there must be bounds to the use of information technology.

Table. 2 Benefits of eLearning

Aspects	Percentage (%)
There is no time limitation on learning	88
Have enough time on your own	45
Effective because it did not charge a tuition fee at the school	39
Easily visualized	18
A number of online resources to support e-learning	15

Many students have embraced the e-learning platform (Table 2), and the scores were in line with our expectations. The convenience of staying at home, away from family and friends, especially for urban students who can avoid traffic and long commutes, proved to be a significant factor when identifying the most significant benefit of online learning. As a result, most students have opted for online learning. Another advantage is the ease of accessing all resources in one place, which is much simpler than searching in bookstores or relying on

borrowing resources from others. It is noteworthy that many recognize electronic learning as a valuable option for those with limited mobility. Additionally, easy access to information and the absence of fixed learning schedules provide students with a sense of freedom. However, it's essential for educators to effectively manage students through goals and required reports to ensure that this flexibility does not become a hindrance [22].

As we can observe, e-learning exercises have allowed learners to practice self-directed learning, combining various learning methods, utilizing their extra time, and making students more tech-savvy. This blended learning approach has consequently enhanced constructive learning. It is essential to encourage this approach and avoid making generalizations about the new system based solely on a single experiment. Therefore, there is a need for testing several successive treatments and a variety of courses in the future.

The pandemic has led us into an unfamiliar life, particularly regarding the learning of mathematics at the university level. The results of this analysis are certainly not representative of learning in normal circumstances. Furthermore, this study focuses on mathematics learning, where the application of e-learning presents new challenges for both teachers and students in terms of explaining mathematical concepts online [23; 24]. Additionally, it reveals that teachers prefer to use widely available online learning platforms like Google Classroom and video conferencing tools like Zoom rather than relying on e-learning systems developed by colleges or universities. The results suggest that instructors are not entirely satisfied with the features and services provided by university-level e-learning platforms.

Researchers suggest the implementation of an attendance system that can be accurately verified and transferred within Excel, along with the incorporation of video conferencing features. This recommendation holds significant merit because it aligns with the concept of meaningful learning [25; 26; 27].

Questionnaire about e-learning

1. What kind of recorded video conferencing is the most efficient way to learn?
2. What is the experience with online earnings from home digitally?
3. Among the digital approaches, which one motivates you to learn?
4. Which of these digital collaborations allows you to work on a specific task that you feel comfortable doing?
5. Which methods will personally engage you in digital learning?
6. What is your preferred method of dispelling doubts about online learning?
7. Do you agree to electronic learning as a new form of learning?
8. If you missed school yourself recently, why did you miss school?
9. If you have recently missed the on-line courses, why did you miss the courses?
10. Are you satisfied with how much time you spend talking to your professor?
11. What is the challenge or ease of using distance learning technology (computer, tablet, video calls, learning applications, etc.)?
12. How hard or easy is it for you to connect to the Internet to access your academic work?
13. On the whole, how interested are you in your courses?
14. If you have recently missed the on-line courses, why did you miss the courses?
15. What's your problem at school right now?

Teachers and Students Ideas for Effective Online Education Math

Teachers emphasized that online teaching is fundamentally different from traditional classroom learning and teaching. Educators require training in the effective utilization of specialized mathematical software to better support many students at both the primary and higher education levels. Alongside training, reliable and continuous internet connectivity, as well as high-resolution cameras, are essential for effective online teaching to facilitate bidirectional interactivity.

Students suggested that online educators should not rush through their teaching. Familiarity with specialized mathematical programs is crucial for both students and educators. Moreover, the use of interactive whiteboards and improved screen-sharing techniques should be explored to enhance the effectiveness of teaching and learning mathematics. It is essential that all students receive customized training, covering various specialized online math software applications.

Difficulties of using online learning

Utilizing e-learning as a substitute for in-person learning during the COVID-19 pandemic was the most prudent choice to ensure student safety while continuing education [15]. In the preceding section, e-learning was shown to offer several advantages. However, it has also presented challenges for both teachers and learners. Students have encountered difficulties in comprehending course materials, and there has been an increase in complaints related to electricity and internet costs. Some students lack the necessary resources to engage in online learning, and there is a prevailing perception among students that e-learning has not yielded optimal results. Additionally, a lack of motivation for e-learning has been observed [28].

When it comes to mathematics, which involves abstract concepts and high-level thinking, students have found it challenging to grasp the material presented through online learning. Consequently, they have become less enthusiastic and perceive the quality of their education to be less than ideal. The increased expenses associated with consistent internet access have also led to complaints from students regarding their participation in online learning [19]. Issues related to students' capabilities, learning experiences, financial concerns, motivation, and feelings of peer isolation have emerged as barriers to the effective implementation of e-learning.

Conclusion

Based on the responses received, the study revealed overwhelmingly positive perceptions of online education, although some challenges were also identified. The primary objective of this study is to underscore that e-learning is an educational approach that should be adopted more widely in the near future. In an academic context, the adoption of online learning hinges on students' acceptance and attitudes toward the potential implementation of an online learning system, as well as the development of online learning materials. Consequently, obtaining feedback from learners is of paramount importance.

Additionally, the findings of this study could serve as a foundation for future educational initiatives aimed at implementing blended learning, which combines both in-person and e-learning components. Nevertheless, it is recommended that further research be conducted to explore the challenges of e-learning from the perspectives of both students and teachers. This research could lead to the discovery of suitable and effective e-learning models for high school mathematics education.

Outcome of the survey:

1. Online learning makes it easier for students to learn at their own pace in a comfortable way.
2. Students prefer to learn from video conferences given by their faculty addressing the topic.
3. Online courses are more efficient because they offer PPPs to all students.
4. Students do not have disruptions that make learning more efficient.
5. Students can make their doubts clear during classes.

To improve the quality of online education, the government should ensure that all students have access to computers and a reliable internet connection. Furthermore, the education sector should establish an official online virtual platform for e-learning, allowing students to easily access all the necessary information in advance. It is also essential to allocate a dedicated network to alleviate network congestion.

Guidance should be provided to teachers and parents to encourage students' participation in e-learning courses and to help them achieve effective learning outcomes.

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