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The role of e-learning in enhancing digital thinking skills among university students

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Abstract

This paper explores the role of e-learning in enhancing university students' digital thinking skills. The descriptive approach is used. The research sample includes a sample of 120 male and female students randomly selected from the faculty of Arts at Al-Zaytoonah University of Jordan. The results indicate a medium degree of approval regarding digital thinking skills using e-learning in teaching. The research paper recommends furnishing students of the Faculty of Arts with digital training programs to enhance their digital skills and activate online learning programs in virtual classrooms. This paper enriches the Arab and Western libraries with original academic contributions and scholarship to knowledge about the significance of adopting digital thinking skills among students in daily life situations. Other key implications are reflected in activating electronic educational programs in virtual classrooms, developing educational programs specific to e-learning and encouraging teachers to use electronic curricula in e-learning. The paper recommends conducting a study on the effectiveness of e-learning in developing critical thinking skills, meta-digital thinking, advanced thinking skills, and meta-digital thinking skills regarding future research work. Conducting a study on enhancing digital learning abilities among pre-university and university students is one of the primary implications.

Keywords: Digital, E-learning, Skills, Students, Thinking, University.

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1. Introduction

The rapid development in e-learning patterns has added many electronic interaction and communication tools that had a positive impact in addressing many learning and teaching problems among students such as overcoming the restrictions

of place and time and enhancing students' interest in e-learning methods. The world's current digital revolution has produced a wide range of electronic tools that rely on continuously offering students e-learning services, including websites for managing e-learning, making academic decisions, and promoting communication through chat, dialogue and expressing thoughts, feelings and actions due to a concurrent opinion or idea [1]. Accordingly, the simultaneous presence of the people involved in the contact over the internet affects students' learning, attitudes and motivation to learn [2].

According to Al-Tuwairiqi [3] e-learning in its various forms is one of the education-based systems represented by the student, the teacher, the educational content, and the educational institution. This system includes a digital electronic environment that depends on digital electronic communication systems and their elements as the success or failure of the e-learning environment in achieving the goals depends on the degree of interactivity and flexibility achieved through designing education through the Internet and communication technologies. It also depends on meeting the students' needs in communication and interaction with the teacher and the e-learning resources available through the Internet.

E-learning is a term that refers to tools that allow users to communicate directly. It is characterized by bringing together the teacher and the student in the exchange of information, lessons, and discussions between the teacher and the student at the same time and place. This is done through virtual classrooms and chat programs [4]. E-learning requires students to be in front of the computer for discussion and conversation between the student and the teacher and receiving lessons through virtual classrooms. Moreover, the goal of using e-learning environments in education is to support and improve the learning process using communication tools in the e-learning environment. It is also believed that e-learning will be imposed on educational systems as the digital educational institution will become a source for the learner indicating fundamental changes in the education process.

E-learning tools are rapidly evolving, confirming the need for digital students to use digital thinking skills in learning with the development of communications technologies and information. Thus, e-learning has become more widely used in the education-based process as other related terms have emerged such as synchronous e-learning, virtual learning, and virtual classrooms. E-learning also refers to education using technology, communication networks and their various tools, where educational content is spread across websites or extranets as this method allows the use of links with other sources Al-Tuwairiqi [3]. Barai [5] showed the role of communication technology and information in e-learning through the fast, informational, and interactive methods it provides for the learner as e-learning environments differ according to the learning environments provided to the learners.

Adzaai [6] identified the following three types of environments: direct online learning, blended or mixed online learning, and supported online learning. The first educational environment, "the direct online learning environment" is distinguished by the fact that the education-based material is provided entirely over the network while the second environment, "the blended learning environment is characterized by the fact that the learning process is conducted in an integrated manner with traditional learning in the classroom. However, the third environment, the supportive learning environment refers to the use of the network by learners to download course materials and use various information sources. Moreover, the use of electronic resources and their technologies in the educational process is one of the basics of learning and teaching as it has imposed itself as an educational necessity that can be used in various educational institutions. With this thorough introduction, the related literature review is detailed in section two.

This research significance is evident in the new academic addition reflected in the role of e-learning in enhancing digital thinking skills and values as it will open the eyes of scholars, researchers, and concerned university officials toward the significance of furnishing students with these digital thinking skills and values. The significance of research also lies in the fact that this paper will enhance the attitudes of students and scholars towards using digital technology in the learning-teaching process.

Another key point justifying the originality of this work from previous ones is that this research addresses digital thinking skills which are updated subjects that need extra analysis and investigation as a future research area. Another important idea is that no studies have been done to speak of the significance of digital thinking skills in the Arab region, mainly in Jordan. At the local level, what is new and refreshing about this paper is that this paper enriches the Arab and Jordanian libraries with original academic contributions and scholarship to knowledge about the Jordanian research works that enlighten the current and new generations about the significance of adopting the digital thinking skills among students in daily life situations [7]. There is a need to develop digital thinking skills and values among university students. Accordingly, the research problem is articulated by answering the following question:

What is the role of e-learning in enhancing digital thinking skills among the students of the Faculty of Arts at Al-Zaytoonah University of Jordan?

2. Literature Review

The needs of the students and teachers to develop digital thinking are theoretically documented [2, 3, 8]. They also recommended enhancing digital thinking skills among students and teachers based on the countries' visions. Universities have provided students with digital thinking skills and search for knowledge through their various sources within their training programs. However, numerous literature works and studies have indicated shortcomings in providing students with digital thinking skills and the lack of achievement of the skills of digital learning among most students which are needed in the digital age [9]. Previous studies also show that digital training programs neither accomplish their objectives nor produce a suitable change in the teaching models that students are used to. Therefore, it has become a requirement for education in the digital age and knowledge to reformulate the digital thinking skills necessary for students considering the digital technology that has imposed itself on the educational process through continuous digital training for students and teachers.

Education in the digital age requires computerizing curricula based on the requirements of e-education and motivating teachers and students to develop their skills in dealing with digital and information sources. The stereotypical teacher who focuses only on memorizing and transmitting information no longer has a place in modern educational systems considering the information revolution that focuses on modern technological methods in designing and implementing education. Teachers and students in the digital age are required to be able to use, manage, and use technology in the education process and develop their knowledge and skills that enable them to absorb modern and continuously developing technology.

Achieving the requirements of digitization in education requires various educational institutions to provide and train students and teachers in digital thinking skills, including digital thinking skills, information literacy, economic and commercial literacy, search skills through various engines, skills in dealing with modern technical applications and knowledge management and skills in communication and collaboration. Many studies have addressed digital thinking and digital skills whether in terms of defining them, measuring their level among the targeted samples or developing them among the parties to the educational process as their results confirmed the importance of e-learning in developing digital skills among students and teachers [2, 3, 5, 10, 11]. E-learning can play a major role in enhancing digital thinking skills among students and teachers. It also ensures students engagement in e-learning without being restricted by time and place, helps them innovate, create, communicate effectively and master technical skills by using multimedia represented by the Internet, computers, mobile phones, and smart tablets outside the school and linking them to real life which helps in effective participation in society.

The need to spread, develop, and support digital skills among students and teachers have increased considering the digital transformation in education. Al-Qarni [12] states that digital skills are a criterion for judging student behavior while using electronic applications. Students know their duties and rights and benefit from their positives and ways to prevent harm. There is a lot of bad behavior in their use which has caused some problems for students, teachers and parents including addiction to information and communication technology and ignorance of the standards and laws for using applications and social networking sites, and others. Many studies and research were conducted to examine digital skills from different angles. Al-Tuwairiqi [3] investigated the impact of e-learning tools on developing digital skills among secondary school teachers in Makkah Al-Mukarramah. The descriptive-analytical approach is also used. The finding indicated that the degree of female teachers' possession of digital culture skills, dialogue, and digital communication is high. It is also found that there is an impact of applying electronic teaching tools in developing digital skills among female teachers.

From different contexts, Al-Shabl [2] identifies the reality of digital learning in improving the skills of the 21st century from the viewpoint of mathematics teachers and supervisors in schools in the KSA. The descriptive-analytical approach is also used. A questionnaire consisting of three dimensions of digital learning skills was also adopted as a research instrument. The results showed that the degree of strengthening the water resources of the twenty-first century is medium among female teachers. The most important factors that hinder the role of digital education in strengthening these resources are spatial and technical factors.

Moreover, Al-Qarni [12] examined the degree of contribution of Saudi universities in promoting digital values, principles and skills among their students by downloading all that was published on the official websites of the universities. The universities' electronic pages were downloaded based on a special card consisting of nine main principles of digital skills. The results indicated that three principles of digital citizenship outperformed the other nine principles, namely digital communication, digital fitness and digital connection.

Additionally, Barai [5] identified the impact of using e-learning in developing digital learning skills among female graduate students. The semi-experimental approach is also used on a sample of 22 female students. The digital learning skills test was also used as a research instrument. The results showed that the use of e-learning contributes greatly to developing digital learning skills. Furthermore, Al-Shahri [8] identified the level of digital learning skills and trends towards their use in teaching mathematics among students at the School of Education at King Khalid University. The results showed that students' proficiency in digital learning is between medium and high in grasping the basics of digital learning needs.

On the other hand, Al-Aoun [13] identified the degree of possession of Islamic education teachers in Jordan of the digital learning skills necessary for distance learning. It was shown that the degree of possession of Islamic education teachers of these skills is medium. Al-Yami [14] revealed the effectiveness of a proposed training program to develop digital learning skills among general education teachers in the KSA. The results showed a statistically significant difference in the performance of the two post-study groups in favor of the experimental group. Besides, Nedime [15] identified schools' readiness for digital education and teachers' attitudes toward using digital learning. The findings revealed both favorable and unfavorable opinions towards the use of digital learning as well as a lack of usage of these tools in the academic process.

Furthermore, Al-Zboun [9] identified the degree of availability of the requirements of digital learning skills in teaching Islamic education from the viewpoint of a sample of Islamic education teachers in the governorates of Ajloun and Jerash in Jordan. The finding indicated that the degree of availability of the requirements for applying digital learning is medium. At the same level, Dogan and Al-Jaber [16] revealed the effectiveness of digital learning in developing some scientific, cognitive, and metacognitive thinking skills among secondary school female students in schools in Al-Ahsa Governorate in the Kingdom of Saudi Arabia. The findings indicated the effectiveness of using digital learning in developing scientific, cognitive, and metacognitive thinking skills among female students.

A thorough analysis of the previous research work and studies demonstrates that the current research agrees with some studies focusing on developing digital thinking and digital learning skills and their use in the education-based process (see [2, 5, 8, 12, 14, 16]). However, the current research differs from those studies addressing the reality of utilizing digital learning in the educational process (see [9, 13]). However, the current research has taken advantage of the studies investigating digital skills [5, 12] in constructing theoretical literature and designing its instruments. The following section presents the relevant research problem with a thorough literature review.

3. Research Problem

E-learning is one of the teaching methods in which communication and interaction tools play a fundamental role in overcoming the problem of long distances between the teacher and the student [17]. Interactive content is provided based on interactive multimedia, supporting different learning styles, new channels, and teaching methods that contribute to activating and increasing motivation towards learning and enriching the learning environment as distance learning is provided in educational environments in which communication is continuous between the teacher and the student through e-learning [18]. Similarly, Lieberman [11] believes that e-learning is a system that includes the presentation of well-prepared educational content through interaction interfaces that harmoniously include appropriate tools between educational content, presentation system, and infrastructure as e-learning environments are based on three areas of functions, namely, the presentation of educational content, the management of distance learning, and the development of its materials and tools.

At the local level, Al-Zaytoonah University of Jordan (ZUJ) now works on providing students with digital thinking skills using technological techniques in line with the vision of Jordanian universities to introduce digital and technology into the educational process and enhance students with advanced digital learning skills to improve the educational process. Furthermore, scholars being lecturers in universities demonstrate that there is a shortage and weakness in digital thinking skills among students. A representative survey study was conducted to identify the extent of students' knowledge of digital thinking skills and applied to a random sample of 20 students given these university-based observations. The findings indicated that students were deficient in practicing digital thinking skills and were not aware of the standards of appropriate behavior associated with the use of technological innovations in addition to the low level of awareness and knowledge of digital thinking skills, values, and dimensions. The previous research results confirmed several weaknesses in the digital thinking skills and values (see [2, 3, 5, 12]).

4. Research Terms and Definitions

In this research study, the terms "e-learning" and "digital thinking skills" are mentioned and their procedural definitions are as follows:

E-Learning: It is a means that supports the education-based process and transforms it from the stage of traditional learning and memorization to the stage of creativity, interaction and skill development. It combines all electronic forms of education and learning as it uses the latest methods in the fields of education by relying on computers, their storage media, and their networks [19]. Procedurally, it refers to the learning process in a multimedia and technical environment to expand the educational process in time and space and enable students to master digital thinking skills.

Digital Thinking Skills: These skills refer to the basic digital thinking skills of a digital learner such as digital thinking skills for managing digital learning, digital thinking skills for using digital learning applications and digital thinking skills for applying digital learning [3]. Procedurally, these skills refer to the digital thinking skills that are necessary for university students in general and students of the Faculty of Arts in particular at Al-Zaytoonah University of Jordan.

5. Method

5.1. Research Design

The descriptive approach is used to identify the digital thinking skills necessary for university students in general and students of the Faculty of Arts in particular at Al-Zaytoonah University of Jordan given the specific scope of the research problem, research objectives, and research questions raised in this article.

5.2. Research Population

The research population consists of 1500 male and female students at the Faculty of Arts at Al-Zaytoonah University of Jordan. However, the research sample includes a sample of 120 male and female students randomly selected from the Faculty of Arts at Al-Zaytoonah University of Jordan.

5.3. Instrument

A based-item questionnaire, the Digital Thinking Skills Questionnaire (DTSQ) is created and modified to accomplish the research goals using previous studies as well as theoretical and practical literature (see [2, 5, 8, 12, 14, 16]).

5.4. Validity Test

The suggested questionnaire is reviewed and validated by 10 experienced and specialized faculty members in the technology of education and educational psychology in Jordanian universities to check the research instrument's validity. The comments, modifications, and recommendations proposed by the reviewers and validators are considered where the items have obtained an approval rating of 91% or more. The necessary action is taken with the items suggested to be deleted, modified or reformulated and thus the questionnaire in its final form consists of 20 items of "digital thinking

skills" distributed over 4 digital skill dimensions, namely "digital thinking skills for the digital learning, digital thinking skills in managing digital learning, digital thinking skills in using digital learning applications and digital thinking skills in applying digital learning" as each skill has 5 sub-major digital thinking skills. The internal consistency validity of the questionnaire was also checked by measuring the correlation coefficient between the degree of each dimension and the overall degree of the questionnaire by applying it to the same survey sample mentioned in the research problem as all the correlation coefficients for the dimensions were more than 0.65 and statistically significant at the significance level of (α = 0.05).

Moreover, the internal consistency validity of the questionnaire was also confirmed by calculating the correlation coefficient of each dimension with the related dimension. The correlation coefficients of the questionnaire dimensions ranged between 0.66 and 0.72 while the overall correlation coefficient of the questionnaire is 0.68 demonstrating that the correlation coefficients for the questionnaire are supportive for implementation and application.

5.5. Reliability Test

The split-half reliability was calculated where the reliability coefficients for the questionnaire dimensions ranged between 0.78 and 0.86 and the overall reliability coefficient was 0.82 to check the research instrument reliability "the questionnaire". Moreover, the research instrument reliability was also calculated using Cronbach's alpha for the questionnaire's dimensions where the values of the correlation coefficients ranged between 0.78 and 0.86 and the overall reliability coefficient was 0.82. Thus, these values are statistically acceptable which means that the questionnaire has an appropriate degree of reliability and can be applied to the research sample. Accordingly, these values are statistically acceptable, and thus the questionnaire has a degree of reliability making it applicable to the research sample.

Regarding data analysis and statistical processing, means, standard deviations, ranks, and degrees are used to answer the research question. Similarly, Cronbach's alpha coefficient is used to find the internal consistency coefficient of the research instrument. The degree of using e-learning in enhancing digital thinking skills among university students is also determined by using the following equation:

Length of one category = (The highest value of the mean - the minimum value of the mean) ÷ Number of levels = (5-1) ÷ 3 = 1.33.

By adding 1.33 to the minimum value of the alternative (the minimum), the criterion for expressing those levels is as follows: the mean ranging between 1-1.33 indicates a low degree, the mean ranging between 1.34-3.66 indicates a medium degree, and the mean ranging between 3.67-5 indicates a high degree.

6. Results

6.1. Results Related to the Research Question

What is the role of e-learning in enhancing digital thinking skills among the students of the Faculty of Arts at Al-Zaytoonah University of Jordan?

The means, standard deviations, degrees and ranks for the research sample's responses to the Digital Thinking Skills Questionnaire (DTSQ) were calculated to answer this question. Table 1 illustrates those results.

Table 1.
Means, standard deviations, degrees, and ranks for research sample's responses to the digital thinking skills questionnaire (DTSQ) necessary for e-learning.

Rank	No.	Text of items	AM	SD	Degree
1	16	Using digital platforms to present lessons in virtual classrooms.	3.22	0.72	Medium
2	13	Using modern technology through computers and the Internet.	3.12	0.77	Medium
3	2	Dealing with different Internet browsers in research tasks.	3.08	0.76	Medium
4	17	Dealing with cloud computing services and using them in e-learning.	2.94	0.77	Medium
5	14	Managing time when using technological websites.	2.88	0.82	Medium
6	3	Taking advantage of digital communication technology in the educational process.	2.74	0.88	Medium
7	20	Understanding how to be responsible and safe online.	2.72	0.89	Medium
8	1	Finding and using related information on the internet.	2.70	0.91	Medium
9	18	Arranging, saving, copying, and displaying files in virtual classrooms.	2.67	0.92	Medium
10	15	Managing dialogue and discussions in virtual classrooms.	2.64	0.93	Medium
11	6	Controlling the mute button to organize interventions in virtual classrooms.	2.60	0.94	Medium
12	11	Using multimedia to convey ideas to the lecturer and students.	2.56	0.96	Medium
13	7	Having positive communication with the lecturer and colleagues in virtual classrooms.	2.54	0.98	Medium
14	10	Exchanging information with others at high speed.	2.51	0.97	Medium
15	1	Performing activities and in-depth information in the virtual classroom with high quality.	2.47	0.92	Medium
16	9	Having skill in retrieving deleted files and data.	2.43	0.93	Medium
17	4	Having collaborative learning through available digital communication applications.	2.42	0.94	Medium
18	8	Spreading culture in social circles.	2.38	0.96	Medium
19	5	Using multimedia such as editing images, sound, and colors.	1.32	0.98	Low
20	12	Being aware of how to use different Microsoft 365 office programs in e-learning.	1.28	0.97	Low
Overall instrument degree			2.68	0.89	Medium

According to Table 1, the overall means of the research sample's responses to the Digital Thinking Skills Questionnaire (DTSQ) requirements necessary for students of the Faculty of Arts at Al-Zaytoonah University of Jordan were 2.68 with a medium degree of approval, ranging between 1.28 and 3.22. Item 16 stipulating "using digital platforms to present lessons in virtual classrooms" is ranked first with a mean value of 3.22, a standard deviation of 0.72 and a medium degree of approval. Furthermore, item 13 stipulating "using modern technology through computers and the Internet" is ranked second with a mean value of 3.12, a standard deviation of 0.77 and a medium degree of approval. Moreover, item 5 stipulating "using multimedia such as editing images, sound, and colors" is ranked penultimate with a mean value of 1.32, a standard deviation of 0.98 and a low degree of approval. However, item 12 stipulating "being aware of how to use different Microsoft 365 Office programs in e-learning" is ranked last with a mean value of 1.28, a standard deviation of 0.97 and a low degree of approval.

In the same context, items 16, 13, and 2 stipulating "using digital platforms to present lessons in virtual classrooms", "using modern technology through computers and the Internet" and "dealing with different Internet browsers in research tasks" are ranked in the first places with the highest means on one hand. On the other hand, items (8, 5, and 12) stipulating "spreading culture in social circles", "using multimedia such as editing images, sound, and colors", and "being aware of how to use different Microsoft 365 Office programs in e-learning" are ranked in the lowest places with the lowest means.

7. Discussion

7.1. Discussion Related to the Result of the Research Question

The current research results indicate that the responses of the entire research sample to the Digital Thinking Skills Questionnaire (DTSQ) achieved a medium degree of approval regarding the possibility of developing digital thinking skills using e-learning in teaching. Besides, these results may express the awareness of the students of the Faculty of Arts of the requirements of e-learning to practice digital thinking skills to make the e-learning process successful through virtual classes. However, they still need to learn many digital learning skills and digital thinking skills. This result may be due to a lack of financial, human, or technical resources which may prevent the acquisition of digital thinking skills necessary for effective e-learning. This is also attributed to the fact that organizing the e-learning environment requires specific technical equipment, tools, and means that are not available in many educational institutions and schools. This result is in line with the results of the studies Al-Shabl [2]; Al-Shahri [8]; Al-Tuwairiqi [3]; Al-Zboun [9] and Barai [5] demonstrating the possibility of developing digital thinking skills and digital education skills through e-learning at a medium level.

8. Conclusion

In a nutshell, the results demonstrate a medium degree of approval regarding the possibility of developing digital thinking skills using e-learning in teaching with the key analysis and discussion conducted in the current paper to recognize the role of utilizing e-learning in enhancing digital thinking skills among university students. Another key point relating to results is that students of the Faculty of Arts at Al-Zaytoonah University of Jordan still need to learn many digital learning skills and digital thinking skills. This result also shows a lack of financial, human or technical resources hindering the acquisition of digital thinking skills necessary for effective e-learning, as organizing the e-learning environment necessitates using specific technical equipment, tools and means not available in many educational institutions and schools.

9. Implications

Among the main implications of the results discussed above is the provision of digital training programs for Faculty of Arts students to improve their digital literacy while developing their digital thinking skills. Other key implications are reflected in activating electronic educational programs in virtual classrooms, developing educational programs specific to e-learning and encouraging teachers to use electronic curricula in e-learning. Regarding future research work, the paper recommends conducting a study on the effectiveness of e-learning in developing critical thinking skills, meta-digital thinking, advanced thinking skills, and meta-digital thinking skills. Among the main implications is conducting a study on improving digital learning skills in pre-university and university students.

10. Limitations

This article includes various limitations that create opportunities for future research regardless of its key and valuable insights. First, human limitations are represented in selecting a random sample of male and female university students. Secondly, spatial limitations are reflected in conducting this research study at the Faculty of Arts at Al-Zaytoonah University of Jordan. Thirdly, temporal limitations are reflected in conducting this research study in the first semester of the academic year (2024/2025).

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