

Review: Types of E-learning Technologies

Laila Abdullah Esmeda, Rema Farhat Farhat, and Ayiman Khalleefah Ali.

Faculty of Information Technology, AlAsmarya Islamic University

la.esmeda@asmarya.edu.ly, rema.farhat@asmarya.edu.ly, and em.khalifa@asmarya.edu.ly

Article information	Abstract
<p>Key words Education, E-learning, technologies and Trends, Blended learning</p> <p>Received 6 /5/ 2022, Accepted 24 /8/ 2022, Available online 12 /9/ 2022</p>	<p><i>This study focuses on E-learning technologies that have the potential to facilitate teaching and learning strategies by using the different computer tools. Nowadays, the applications of E-Learning become the most applicable in all levels of education, and this is owing to the widespread of the COVID-19 pandemic. The trends of E-learning prevails the new form of foundations for future direction and development for educational and training purposes. The trends to the learning process can be blended learning, micro learning, gamification, personalized learning, and Massive Open Online Courses. This study aims to investigate the E-learning concept; to highlight advantage and disadvantage of E-learning; to find out the important aspects of E-learning, and how to implement this technology in the education system in order to improve the educational level and reach the desired outcomes. The findings of this study reveal that Blended learning is the most effective and convenient for implementation. Moreover, E-learning has benefits because it has the potential to move from traditional learning to e-learning, especially in applied sciences.</i></p>

I. INTRODUCTION

- II. Since 1960, electronic Learning (E-learning) and Computer-assisted Learning (CAL) are considered as one application system in the era of computer technology. The adoption and popularization of these 2-application systems begins after the internet and web popularizations. After that, the E-learning rapidly evolved in the field of technology and its methods/applications. Researchers believe that teachers/instructors, education groups, business groups, military groups and students are the most benefited in this E-learning application.
- III. Due to rapid growth in computer technology, IT development becomes extremely fast in transferring and updating knowledge. E-learning platform used in social development and interest of the common people. Based on new technology digital media and resources becomes available in all internet network applications. It is widely used for applications and processes in which available in electronic media to deliver in all vocational education and training facilities. The term computer-based and web-based learning tools using the applications of mobile technologies are part of learning process in virtual classrooms with collaboration of digital and its uses.
- IV. The users expectations are rapidly grow for new technologies and extremely fast increase productivity using Information Technology.
- V. E-learning is an educational tools or system based in computer that can learn anywhere at any time by different users. Because of the rapid developments of information technology, fast deliver using the combination of computer-based on different methods like CD-ROM becomes easy and valuable. In addition, advanced technologies covers the geographical gap using E-learning tools that the user feels the atmosphere of the classroom environment. E-

learning enables the users to share material in different types and formats such as slideshows, videos, word documents and PDFs. It is also offers the chat and message forums to communicates the users to their professors. [1] [2].

VI. E-learning is a widely used for set of applications and processes which use all available electronic media to deliver vocational education and training. It covers computer-based learning, web-based learning, the use of mobile technologies and it includes virtual classrooms and digital collaboration and uses [2]. The main purpose for E-learning process is to continue the combination to introduce of new information technologies.

VII. Finally, the end-users become accustomed to the technology and demographic profile shifts. It is more recognized by its benefit in technology, becomes a part of their lives, and fully completed by its life technology cycle. E-learning is efficient because it shortens the time requirements to update the users on new products and methods.

II. HISTORICAL DEVELOPMENT OF E-LEARNING

In last years, especially after COVID-19 pandemic, E-learning market-place increasingly has grown rapidly in the field of information technology. There are also many identifiable drivers for ICT-enabled instruction. These can classify as technical innovation, organizational and business developments and needs and demands of the learners [2,3]. There are two common used words that usually describe as E-learning. These are “online learning” and “virtual learning”. However, the principles of E-learning are excellent and well-document throughout the history, and there is evidence that in 19th century E-learning are already exists. The following table below summarizes the development and history of E-learning.

TABLE 1. DEVELOPMENT HISTORY OF E-LEARNING

Period of time	Developments
In the 1840's	Thru mail the course materials were delivered by post and correspondence with tutors [4].
In 1924	First Testing Machine invented. The devices allowed the students to tests [1].
In 1954	BF Skinner, a Harvard professor was invented the “teaching machine”, which enables the schools to administer the program instruction for the students [1].
In 1960	The first Computer-Based Training program (CBT) designed for students attending the University of Illinois appeared and then became widely used in schools [1, 5].
In the 70s	E-learning has become more effective, with the use of the Internet offering a wide range of interactive experiences as well as faster correspondence with students through e-mail [6].
in the 1980's	Individuals were able to have computers in their homes, which helped them increase their knowledge and develop their skills [7].
in the 1990's	Virtual learning environments have grown and people have access to broader E-learning opportunities, schools have been set up to offer online courses and provide education to people who are unable to attend college due to geographical or time constraints, in addition, distance learning costs reducing due to technological developments [1, 8].
2000-2010	The use of electronic means and the Internet. In addition to Web 2.0, intranets and extranets to help learning, gain knowledge and skill building. Thus, the concept of E-learning emerged and appears as important aspect [9, 10, and 11].
2011-2018	Information and communication technologies (ICTs) have been used for learning and gain knowledge by using multimedia and enabling remote

Period of time	Developments
	exchange/ content delivery through networks/ Online education in Universities/virtual interactive class- room sessions [8, 12, 13].
2019- now	The state of emergency and closure around the world that occurred due to the spread of the Corona virus (Covid-19) forced organizations to adopt E-learning, whether synchronous learning model that takes place in the form of live sessions using various conferencing software such as Zoom, google meet, Blackboard and Skype, or learning Asynchronous through the Internet using Whats App, YouTube and learning management systems in educational institutes[14]

III. ELECTRONIC DEVICES USED FOR E-LEARNING

Some electronic devices used for E-learning are computer, television (TV), mobile phone, smart phone, tablet, personal digital assistant (PDA) etc., The Figure 1 shows that during 21st century, the learners are surrounded by the different devices to equip themselves. In comparison, the following learners in new generation have more opportunities to gain knowledge than old generations learners.

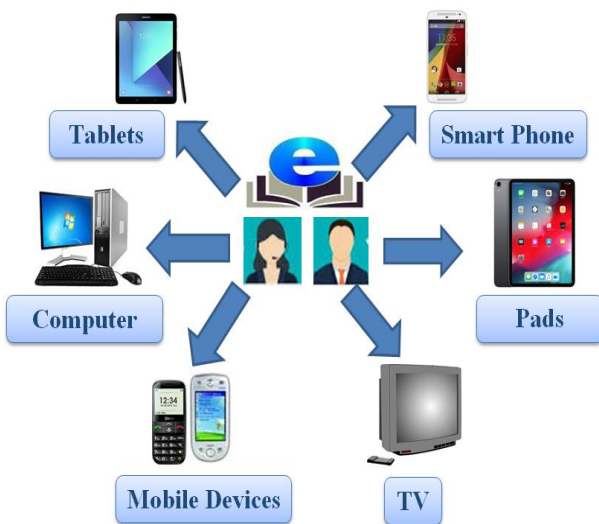


Figure1. Some devices that are used for E-learning

IV. LEARNING CONTENT AND OPEN SOURCE E-LEARNING TOOLS

LMS (Learning Management Systems) is efficiently using in management for the study materials purposes in educational institutions. LMS aids for the distribution of the course materials, assignments and helps in administrating the tools that used by the instructors. Because of communication and collaboration among learners the LMS is become important tool among them. LMS provides a good solution by enables the students communicate with peers and tutors and also learn together online [15]. One of these open source ethnologies is Moodle platform, which is a toolkit that enables users to access shared resources, exchange materials, and use additional auxiliary modules and tools [16].



Figure2. Some devices that are used for E-learning

I. LEARNING CONTENT AND OPEN SOURCE E-LEARNING TOOLS

LMS (Learning Management Systems) is efficiently using in management for the study materials purposes in educational institutions. LMS aids for the distribution of the course materials, assignments and helps in administrating the tools that used by the instructors. Because of communication and collaboration among learners the LMS is become important tool among them. LMS provides a good solution by enables the students communicate with peers and tutors and also learn together online [15]. One of these open source ethnologies is Moodle platform, which is a toolkit that enables users to access shared

resources, exchange materials, and use additional auxiliary modules and tools [16].

There are many providers can provide learning management system, and some of them consider the open source applications such as alternative commercial products and other products provider presents powerful and excellent sales products negotiations. Open source software applications are stable and cost saving for ensuring the users can access excellent applications.

In E-learning environment, the content is classified in two classes: the first class, learners through E-learning tool, and second class is learning objects powered by the LMS. The following table below are summarizes the classification of E-learning content [17].

TABLE 2. CLASSIFICATION OF E-LEARNING CONTENT

E-learning tools		learning objects (LO)
Synchronous	asynchronous	
Used by both instructor and learner at same time	used for self-paced learning subscripts, and superscripts	They are scholastic resources that can be employ in digital learning, and can be organize to form learning materials.
Such as video conferencing , virtual classrooms, webinars	Such as reading materials, audio and video, forums, wikis	Can be built with websites, 2D/3D models, text elements, graphic images, videos, applets or source used in learning [19]
Teacher conduct evaluation process at once for the students.	Students don't have the ability to Get feedback from the teacher. [18]	

II. THE BENEFITS AND DRAWBACKS OF ONLINE LEARNING

E-learning management contents are always updated for the excellent performance of the systems. E-learning technology has some important advantages that should be considered. These advantages are as follows:

- Learning modules does not a take long time to start the system applications.
- It conducts fast pacing and an excellent conducive environment for learning modules for the systems. .
- Learners have unlimited time in learning modules for the systems.
- Learners can select and focus on what learning modules will be display.
- Learning modules is a cost effective, where the cost of learning and development is reduced.
- No boundaries and no restrictions.

The design of learning modules is more interactive and fun because of multimedia tools or new developed methods of system.

Although there are many benefits in the use of E-learning, the E-learning has many drawbacks. The main drawbacks are the availability and reliability of the internet operations and the performance of internet access. These drawback has a significant effect on students because students cannot perform correctly and properly the learning modules if the performance, availability and reliability are poor in operations. Moreover, the practical skill in learning modules is one of the important skills to gain in E-learning course.

Another drawback is the effect of students using E-learning systems. The effect is the interaction and socialization between students and their colleagues and between students and their teacher. In spite of flexibility and the ability to access remotely, the classrooms still the best and conducive environment in learning process using E-learning systems.

On the other hand, students can easily overcome of these following drawbacks using the new technology development and advance E-learning benefits in which the teachers, supervisor, and other students are easily contact using different tools of technology such as social media, video conferencing, and discussion forums, etc. [19].

VI. TECHNOLOGIES TRENDS OF E-LEARNING

Recently, E-learning takes place between enormous technologies. It is completely changing the traditional learning patterns format. Furthermore, there are many studies in the area of E-learning, for instance, the study of Magdalene and Sridharan (2005) that focuses on the demands of E-learning and various educational technologies that facilitate the design and application of the E-learning systems [2] and the study of Vivekananda and Ruvn that is concerned with emerging trends of E-learning in India. This study focuses on introducing the new methodologies used by E-learning system, the priorities of each methodology for easy accessing the E-learning systems and the upcoming technological trends in the field of E-learning systems such as Mobile Learning, Micro-learning, Beacon Learning, Internet of Things (IoT), Cloud based E-learning, Gamification and many more [3]. Among the popular technological E-learning trends are as follows:

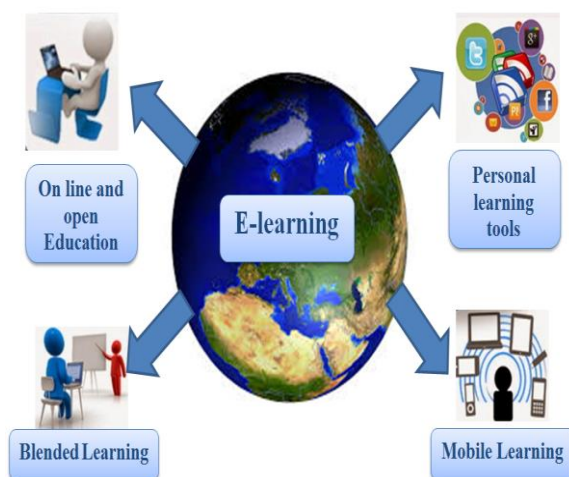


Figure3. Some of E-learning Technologies.

A. Mobile Technologies:

In this technology, learning services will be integrating into mobile technologies as mobile phones, digital pen, paper, and information interfaces. The distinctive attributes of mobile devices, including being portable, available, allowing users to access the Internet, and being widely adopted by members of the younger generation and others, mean that they are viewed as an emerging medium with the ability

to Pushing the boundaries of teaching and learning mathematics outside of the traditional classroom environment [20]. In mobile learning technology, there are two distinct potential markets which to be consider:

- The first market of learning services deals on the people without infrastructure and accessibility to internet and the E-learning systems may not be widespread in rural or remote areas.
- The second market of learning services deals with a certain type of students who needs an individual learning education, on-going study about their external projects, people whose jobs continuously learn about E-learning technology and other people needs to learn and gain more information about the E-learning systems during the browsing, visiting and searching in various sites and locations.

In Europe, mobile learning starts to develop their technology. The telecommunications companies such as Nokia and Vodafone are already integrate these technologies into their training and development systems. However, the development of technology in different sector remains visible to everybody. Any technology development in this market is likely to happen in near future [3, 21].

B. Artificial Intelligence:

In E-learning world, the Artificial Intelligence (AI) is great and ideal tool as well as effective in the field of technology. There are difference between robots and Artificial Intelligence software tools. This software is design in some intelligent actions to recognize entire environment. This technology helps the instructor in making students a good expert in their own field. Some of modern outcome in artificial intelligence learning instructors are some of artificial intelligence (AI) platforms (such as digital assistants: SIRI and VIV) these software used in simple queries from complicated queries of the learners. The involvement of artificial intelligence in E-learning helps the learner to learn on decisions-making and quality resources, and the learner

gain and excel on the system and the achievements of the learners are fast as possible [22].

In addition, Pankaj Jain et al. [23], shows the trend of artificial intelligence technological in student learning. The authors also use a tool named artificial intelligence-based student learning evaluation tool (AISLE), which main purpose is to improve the use of artificial intelligence techniques in evaluating a student's understanding of a particular topic. Moreover, the artificial intelligence used in two directions e- learning tool medium, and evaluates the understanding capability of a student. The authors conclude that the method reduces the time involving in assessing a student understanding of a particular topic and it helps the instructor to compare variability of understanding between various students.

Webopedia and Wikipedia helps so match in offering the information about several technological trends and the current usage of E-learning tools. And, it provides some good meaning for IoT and its future extension.

C. *Virtual and Augmented Reality:*

There are two most recent technologies used for conducting training tasks, these are Virtual Reality (VR) and Augmented Reality (AR). Virtual Reality enables to create a simulated immersive environment, while Augmented Reality enables to mergers the viewer's natural senses with computer-generated information. In the field of online education these technologies gains more attention [24].

Virtual Reality (VR) and Augmented Reality (AR) merge the learners to stimulate, interest and excitement experience. It provides trainees to actively and practice new skill, it enable instructors to attract their students and encourage the students to interact the environment that sparks student imagination and encourages Innovation and deeper learning [25, 26].

D. *Adaptive learning environments (ALEs):*

Several systems that enable to adapt the different techniques in order to assist or encourage various learning aspects [27], also there is evidence last years that the awareness

of the potential benefits of adaptively in E-learning are rapidly increase. By the realization of the ideal for individualized learning (i.e., learning tailored to the specific requirements and preferences of the individual) does not achieve, especially at a "massive" scale, using traditional approaches. The different factors that contribute in this matter are as follows:

- Diversity in "target" population participating in learning activities
- Diversity in access media and modalities that effectively utilize in order to access, manipulate and collaborate on educational content or learning activities and with a diversity in the context of use of different technologies with the anticipated proliferation of free educational content, etc. [28].

E. *Open Source E-learning tools:*

Today, there is large number of providers that provides Learning Management System (LMS). Some of the most LMS well known are (Moodle, ILIAS, eduplone, Claroline, Totara Learn and SAKAI). Most of these products have extensive developer communities and it presents strong arguments for considering open source applications like an alternative to commercial products.

Some of the criteria that to be consider in decision making on choosing the Open Source software applications are having qualifications such as cost savings, stability, performance and accessibility of code.

Some of the criteria that to be consider in decision making on choosing the Open Source software applications are having qualifications such as cost savings, stability, performance and accessibility of code. On the other hand, for assurance of the users in the near future as well as the longer term have access to the best available applications [28].

A. *Cloud based E-learning:*

Cloud based E-learning is a type of E-learning that makes a big revolution in the education and business field. The systems of E-learning are hosts on the internet and easily access by logging into a service provider's site. Instead of installing all the courseware and

software on learner's computer, the instructional designers can be simply use their internet browsers to communicate with learners directly and it uploads the course content and create new courses. By using learner management system all aforementioned done, it also provide the ability of designer to store information on the cloud, which can be accessed remotely by other, approved users [29].

Using this type of E-learning methodology there are several advantages to be consider such as cost predictability, faster deployment, more storage space, easier to maintain, fully customizable and scalable, and learner oriented service request. Furthermore, several experiments has been carried out and investigate by Jovan Dašić et al. [30] to define where such learning provides a good opportunity to develop a university organization, preparations of programs and plans.

The essential impact to support in universities and new audiences are the impact of ICT on the interaction between teachers and students, it also effects on the demands of continual professional development and constant learning. Similarly, in the paper of Valentina Arkorful and Nelly Abaido [31], presents the outline of E-learning role and effectiveness of integration in Higher Education. The above authors also gives good model for using E-learning in education, which classifies the online learning into individual and collaborative learning that can be of synchronous and asynchronous.

B. Micro Learning:

Micro learning is a way of teaching and content delivery to learners in small very specific impulse. The learners can control the kind of learning tools. It will conduct on how, what and when the learning content delivers. Usually, it design and provides different formats of rich media. Micro – learning is a learner-centric method provides just-in-time training, which is available on multiple devices.

All the above mentioned features are guarantee that can easily access, quick complete, and easily applied by the learners [3]. The micro-learning expands enormous benefits for business environments such as affordable,

shorter development cycle, wider application, easy to update, and high impact. What is more, the study of Tubaishat and Lansari reveals good dissection about readiness of students, restricted to E-learning perception of gulf region and it indicates that students have very high acceptance to E-learning in their regional institutions.

A. A Social learning:

The study of Bezhovski and Poorani indicate [33] the availability in technology and the different E-learning tools that encourage and support the learning process. It is evident that E-learning is widely used in different applications such as education, training and business, and it is expected to grow more and more in the future.

However, there is insufficient evidence of the specific effectiveness of the different pedagogical methodologies used for E-learning. Also, it explores the current state in E-learning and new trends form the foundations for future direction and development in the field of educational and training purposes. Although Social Learning Environment (SLE) seems as social network the purpose of this tool is to serve as an interactive learning space to provide an ability of communication between students and teachers, and to encourage students in active learning through collaborative problem solving tasks. Furthermore, SLE aims to integrate the functionalities of social networks with the learning formats, but under the control of appropriate pedagogical method [34]. Moreover, social learning is one of the top E-learning trends of the recent years. It involves collaboration between individuals at the workplace through various modes, such as forums, informal chat sessions, sharing sessions, and learning circles.

B. Internet of Things (IoT):

Internet of Things (IoT) describes the type of increasing grow network of objects or physical things around world which holds an internet protocol (IP) address for the connection in the internet, and the communication between these connected objects and other internet enabled devices and systems.

In learner's point of view there's an instant learning that can be used such as daily study exercises. IoT is a very powerful tool, and in this type of technology, the user or learner can be considered as an object in the whole system, and the system will detect the new update and specific learner IP. Moreover, it gives the updates of the whole network for physical objects or devices, which is connected [35].

C. Gamification:

Gamification is type of E-learning that conduct games and it depends on the program and the audience requirements. The gamification of education can enhance levels of students' engagement similar to what games can do, to improve their particular skills and optimize their learning [36]. Children get a lot of benefit from this kind of E-learning because it creates an interest and makes repeatedly use for long time. Gamification helps the online learners to acquire knowledge and skills more effectively, it also allows the learners to retain the information and commit it to long- term memory for the future use [3].

Some of the significant paybacks of the Gamification in E-learning are as follows: better learning experience, takes a master level, instant feedback, better learning environment, and helps to remember for long time. Whereas, Jui-FengWeng et al.,[37] presented the E-learning as a game using of Boolean logics. In addition, it explain how interest to learn the same Boolean logic with the usage of computer simulations. The authors also specify that even the difficult things become easier to earn and remember for very long time as simulated games on computers through E-learning.

F. Video E-learning:

This kind of learning helps the learner to understanding the content of specific course by watching the videos. In the other word, a learner visits the youtube.com, when the learner wants to get an idea on some specific topic in details. Video E-learning introduces the idea in fast manner and helps to comprehend the main objective with multimedia affects.

Video E-learning content sources are usually used and search in YouTube website, smart TV, CD's and storage devices. These educational

videos overlays on different kind of E-learning, nowadays video E-learning is on full-swing as it saves time of learner compared to traditional reading (line by line full stuff) on computer or any other electronic device. It is also take a small concentration of the learner than to reading stuff. It serves as very effective medium of E-learning. Video E-learning benefits can be video explanation, best learning experience, and more information in less time.

In addition, incorporating video into E-learning environments may not always be sufficient to improve learning, but using Interactive video that provides individual control over random access to content may lead to better learning outcomes and higher learner satisfaction [38].

III. DISCUSSION

This study have discussed the development of IT areas such as mobile technologies, agent systems, and virtual environments on E-learning system. Today, online universities are very common for distance learning solutions. Because of the increased demand in education area, the distance learning solutions in traditional universities gain these learning solutions. In addition, it is also because of the effect of covid-19 pandemic worldwide, the traditional universities forced to shift from traditional learning solutions into distance learning solutions in order to cope the study in the universities.

Nowadays, Internet and Internet-based applications become the most common and widespread technologies. There is also big impact on the manner in which, it performs on our daily activities. E-learning is one of the areas where attention has been growing dramatically by researches and varies enterprises because of benefits on different directions.

Therefore, this study aims to investigate the E-learning concept; to highlight advantage and disadvantage of E-learning; to find out the important aspects of E-learning, and how to implement this technology in the Libyan education system in order to improve the educational level and reach the desired outcomes.

I. CONCLUSIONS

The educational institutions should own and operate by the E-learning portals and websites for easy and free access to learning resources. The modernization of learning processes and introducing the latest technologies in classrooms are mandatory to encourage both students and teachers to develop their skills and knowledge in achieving the academic and professional objectives. Thus, the preparing for effective digital learning tools becomes a critical demand for different education institutions.

This study concludes that blended learning is the most effective and convenient to implement. Moreover, the E-learning has benefits because it has the potential to transfer from traditional learning to E-learning, particularly in applied sciences. However, developing countries like Libya may be unable to implement the E-learning for many reasons. For instance, Libya is in the post-conflict stage that has a negative impact on Libyan in all sectors, particularly the education system. The most common effect of the conflict is power outage and the Libyan education system is in the rebuilding stage in terms of infrastructure.

REFERENCES

- [1] Epignosis, L. L. C. (2014). E-learning concepts, trends, applications. California: Epignosis LLC, 5(6), 7.
- [2] Magdalene, R., & Sridharan, D. (2018). Powering E-learning through technology: An overview of recent trends in educational technologies. *The Online Journal of Distance Education and E-learning*, 6(1), 60.
- [3] Vivekananda, M., & Ruvn, S. (2017). Emerging Trends of E-learning in India. *International Journal of Advances in Electronics and Computer Science*, ISSN, 2393-2835.
- [4] Hawisher, G. E., & Moran, C. (1993). *Electronic Mail and the Writing Instructor*. College English, 55(6), 627–643. <https://doi.org/10.2307/378699>
- [5] Bersin, J. (2004). *The blended learning book: Best practices, proven methodologies, and lessons learned*. John Wiley & Sons.
- [6] Sivaranjani, B., & Prakash, D. S. (2014). E-learning-An Overview. *International Journal of Engineering and Management Research (IJEMR)*, 4(4), 117-123.
- [7] Klačnja-Milićević, A., Vesin, B., Ivanović, M., Budimac, Z., & Jain, L. C. (2017). Introduction to E-learning systems. In *E-learning Systems* (pp. 3-17). Springer, Cham.
- [8] Rao, V. (2016). E-learning: As a medium of new education technology. *Research Journal Sansmaran July-December 2016*, 2.
- [9] Wentling, T. L., Waight, C., Gallaher, J., La Fleur, J., Wang, C., & Kanfer, A. (2000). E-learning: A review of literature. *Urbana-Champaign: University of Illinois*, 8, 113.
- [10] - Gustafson, K. L. (2002). Future of educational design. In R. A. Re, & J. V Dempsey (Eds.). *Trends and issues in instructional technology* (pp. 333–343). Merrill Prentice Hall.
- [11] Bondarouk, T., & Ruël, H. (2010). Dynamics of e-learning: theoretical and practical perspectives: Introduction to special issue. *International journal of training and development*, 14(3), 149-154
- [12] Liaw, S. S., Huang, H. M., & Chen, G. D. (2007). Surveying instructor and learner attitudes toward E-learning. *Computers & education*, 49(4), 1066-1080.
- [13] ArunGaikwad, V. S. (2016). E-learning in India: wheel of change. *International Journal of e-Education, e-Business, e-Management and E-learning*, 6(0), 1
- [14] Siddiquei, M. I., & Kathpal, S. (2021). Challenges of online teaching during Covid-19: An exploratory factor analysis. *Human behavior and emerging technologies. Electronic devices used for E-learning*.
- [15] Zanjani, N. (2017). The important elements of LMS design that affect user engagement with E-learning tools within LMSs in the higher education sector. *Australasian Journal of Educational Technology*, 33(1).

- [16] Nikolić, V., Petković, D., Denić, N., Milovančević, M., & Gavrilović, S. (2019). Appraisal and review of E-learning and ICT systems in teaching process. *Physica A: Statistical Mechanics and its Applications*, 513, 456-464.
- [17] Bondarouk, T., & Ruël, H. (2010). Dynamics of e-learning: theoretical and practical perspectives: Introduction to special issue. *International journal of training and development*, 14(3), 149-154
- [18] Jacksi, K., Sulaiman, M. A., & Saeed, R. H. (2021). The Importance of E-learning in the Teaching Processor Secondary Schools/Review Article. *Academic Journal of Nawroz University*, 10(1), 53-62.
- [19] Huk, T., Steinke, M., & Floto, C. (2003). Computer animations as learning objects: what is an efficient instructional design, and for whom?. In *ICWI* (pp. 1187-1190).
- [20] Alabdulaziz, M. S. (2021). COVID-19 and the use of digital technology in mathematics education. *Education and Information Technologies*, 26(6), 7609-7633.
- [21] Castro, F., Vellido, A., Nebot, A., & Mugica, F. (2007). Applying data mining techniques to E-learning problems. In *Evolution of teaching and learning paradigms in intelligent environment* (pp. 183-221). Springer, Berlin, Heidelberg.
- [22] Huang, C. J., Chu, S. S., & Guan, C. T. (2007). Implementation and performance evaluation of parameter improvement mechanisms for intelligent E-learning systems. *Computers & Education*, 49(3), 597-614.
- [23] Jain, G. P., Gurupur, V. P., Schroeder, J. L., & Faulkenberry, E. D. (2014). Artificial intelligence-based student learning evaluation: a concept map-based approach for analyzing a student's understanding of a topic. *IEEE Transactions on Learning Technologies*, 7(3), 267-279.
- [24] Alcañiz, M., Contero, M., Pérez-López, D. C., & Ortega, M. (2010). Augmented reality technology for education. In *New Achievements in Technology, Education and Development*. IntechOpen.
- [25] Elmqaddem, N. (2019). Augmented reality and virtual reality in education. Myth or reality?. *International journal of emerging technologies in learning*, 14(3).
- [26] Lee, K. (2012). Augmented reality in education and training. *TechTrends*, 56(2), 13-21.
- [27] Brusilovsky, P. (1999). Adaptive and intelligent technologies for web-based education. *Ki*, 13(4), 19-25.
- [28] Nath, J. (2012). E-learning methodologies and its trends in modern information technology. *Journal of Global Research in Computer Science*, 3(4), 48-52.
- [29] Selviandro, N., & Hasibuan, Z. A. (2013, March). Cloud-based E-learning: A proposed model and benefits by using E-learning based on cloud computing for educational institution. In *Information and Communication Technology-EurAsia Conference* (pp. 192-201). Springer, Berlin, Heidelberg.
- [30] Dašić, J., Dašić, P., & Šerifi, V. (2010). Evolution of E-learning. *Learning*, 4.
- [31] Arkorful, V., & Abaidoo, N. (2015). The role of E-learning, advantages and disadvantages of its adoption in higher education. *International Journal of Instructional Technology and Distance Learning*, 12(1), 29-42.
- [32] Tubaihat, A., & Lansari, A. (2011). Are students ready to adopt E-learning? A preliminary e-readiness study of a university in the Gulf region. *International Journal of Information and Communication Technology Research*, 1(5).
- [33] Bezovski, Z., & Poorani, S. (2016, March). The evolution of E-learning and new trends. In *Information and Knowledge Management* (Vol. 6, No. 3, pp. 50-57). IISTE.
- [34] Raspopovic, M., Cvetanovic, S., Medan, I., & Ljubojevic, D. (2017). The effects of integrating social learning environment with online learning. *International Review of Research in Open and Distributed Learning*, 18(1), 142-160
- [35] ur Rahman, M., Deep, V., & Rahman, S. (2016, January). ICT and internet of things for creating smart learning environment for students at education institutes in India. In *2016 6th International Conference-Cloud*

System and Big Data Engineering (Confluence) (pp. 701-704). IEEE.

- [36] Smiderle, R., Rigo, S. J., Marques, L. B., de Miranda Coelho, J. A. P., & Jaques, P. A. (2020). The impact of gamification on students' learning, engagement and behavior based on their personality traits. *Smart Learning Environments*, 7(1), 1-11.
- [37] Weng, J. F., Tseng, S. S., & Lee, T. J. (2010). Teaching boolean logic through game rule tuning. *IEEE Transactions on Learning Technologies*, 3(4), 319-328.
- [38] Zhang, D., Zhou, L., Briggs, R. O., & Nunamaker Jr, J. F. (2006). Instructional video in E-learning: Assessing the impact of interactive video on learning effectiveness. *Information & management*, 43(1), 15-27