
Research Paper

Applications and Challenges of E-Learning Technologies

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Abstract— The present work investigates the application of e-learning in the education system in the situations of social distancing caused by the pandemic COVID-19. The likelihoods and challenges in the execution of e-learning have been discussed. The recent widely used platforms for e-learning are presented in the present work. An investigation of these platforms, along with their advantages and disadvantages have been addressed. Based upon the analysis conducted, the challenges for the future enhancement and successful deployment of e-learning are addressed.

Keywords— Web Conferencing, E-learning, LMS, Schoology, Google Classroom.

1. Introduction

The concept of e-learning emerged at the closure of the last century, when the internet and the chances of communication and computer technology became accessible to a larger group of audience [1]. E-learning aimed on development of business, providing quick and effective training and retraining of employees initially. But now e-learning is viewed as an option to traditional education system [5].

During the 21st century, e-learning has become the most feasible solution for lifelong learning and on the job training. In a simple way e-learning is defined as technology- based learning in which the learning materials are provided electronically to distant learners through a computer network. One of the aspects is the usage of efficient training methods are vital for organizations to confirm that the channel's employees and partners are trained with the most recent information and advanced skills [2]. The other aspect is that the educational establishments should offer efficient methods for gaining lasting and exhaustive knowledge and skills in scholars and students [4].

The COVID-19 pandemic has resulted in a drastic change in education, converting traditional learning into e-learning through-out the world. The educational organizations were required to quickly reorganize and adapt their educational paradigm to the new pandemic scenario. During the pandemic e-learning was made mandatory for school students. E-learning also proved as a great opportunity for university students as it offered ways to combine the work and also obtain qualified training.

The recent advancements in technology in the 21st century has changed insights of the expansion of education [11], by

connecting it to the development of the internet or the World Wide Web (WWW). The various technology-based methods of education, which follow the growth of the worldwide information network and control the place and role of students, teachers and technology in learning [7] are:

- Education 1.0, which resembles the phase-I of expansion of the WWW - Web 1.0;
- Education 2.0, which signifies the phase-II of expansion of the WWW - Web 2.0;
- Education 3.0, which represents the phase-III of growth of the WWW - Web 3;
- Education 4.0, which represents the phase-IV of progress of the WWW - Web 4.

Actually, the changes that are taking place in education with reference to the Education 4.0, is sprightly connected to the fourth industrial revolution [9, 12].

2. Technologies of E-Learning

The mode of synchronous e-learning is adopted by schools. In synchronous form of e-learning the teacher and students can communicate simultaneously using some real-time tools [3]. This evades the feeling of isolation. But online synchronous communication is inflexible in terms of time in which students can study. It is one of the vital reasons why asynchronous communication has confirmed to be more appropriate to non-formal learning, as well as a form of learning in few universities.

In asynchronous form of learning, the activities are conducted offline [3]. In general, all types of communications like assignments and Home Works are delivered by emails, forums and messages. In other words, it can be interpreted that in asynchronous type of learning students perform self-learning. This

type of learning is preferred by the scholars who want to explore a topic on their own or have daily commitments in learning. The advantages of traditional learning and e-learning is discussed.

The advantages of e-learning are -

- It is learner oriented.
- The learner is flexible in selecting the time and place.
- It is cost effective.
- It is accessible to all audience.
- It offers unlimited access to knowledge.
- It allows reuse and sharing of knowledge.

The advantages of traditional learning are -

- Students and teacher can have instant feedback.
- All the teachers and students get well introduced.
- Students get motivated and build a social community.

The disadvantages of e-learning are –

- Late feedback in asynchronous type of e-learning.
- Teacher training consumes much time.
- Some people find it uncomfortable.
- It offers more anxiety, confusion and frustration.

The disadvantages of traditional learning are-

- Topic coverage take much time due to special attention on students.
- It is uncomfortable for distant students and teachers.
- It becomes more complicated if students are not interactive.
- Sometimes more time is wasted in communicating non important topics.

Irrespective of the selected method of communication, the actual online learning must comprise of both synchronous and asynchronous schemes [6]. The teachers and learners are able to get advantage from the above two types presented irrespective of their schedules or preferred teaching approaches.

A. Essential elements of synchronous communication:

- **Chat:** Chat rooms provide safe option for a large number of users who have synchronous online connection. Chat rooms provide a better place for queries and share resources and opinions. Chat sessions can be archived in .rtf or .txt format, permitting for reviewing and distribution.
- **Internet Telephony (VoIP):** It is employed to conduct conference calls amongst the faculty and the students. Advance planning is compulsory in this option. Here advance planning refers to the preparation of documents or files that will be needed during the call.
- **Web conferencing:** Web conferencing permits for a video connection. It provides live broadcasting from the classroom or home. The main advantage of this service is the ability to distribute slides, various graphics, permit synchronous discussion on different topics, conducting topic related surveys and any other types of collaborative sessions.
- **Audio podcasts:** Audio podcasts offer internet audio connection. The audio file can be saved and listened by the

students at any time suitable for them. The major advantage of audio podcasts is that while it is executing, students can send chat messages and hence be in touch with each other.

- **Virtual worlds:** The students can have live meetings using virtual worlds and converse the topics of their online sessions. Virtual worlds are appropriate for distant learning, as learners can discuss various topics with each other. Headphones, microphones or internet telephones are used for communication in virtual worlds.

B. Essential elements of asynchronous communication:

- **Virtual libraries:** Virtual libraries are used for uploading or downloading different types of audios, video, graphics, presentations, instructions about how to conduct online training and much more. Students can access various educational content any time and from any geographical location using virtual worlds. Virtual worlds permit students to use suitable virtual libraries.
- **Email:** Online training is impossible without emails. Emails provide facilities to send and receive topic related materials, set up reminders, keep in touch, news bulletins and even ratings. Some online tutorials or programs use emails as an essential means of communication amongst students and teacher.
- **Forum:** Forums are the other vital element of any online training. Forums provide facilities for question answering, sharing different links and documents online. Forums are great tools for learners.
- **Social Networking:** Various online courses are already using social networks to enhance interaction and online communication amongst students. In various learning management systems, social networks are built-in as functionality. Some examples of most commonly used social networks are Wikis, Facebook, blogs, Twitter, YouTube and more.
- **E-portfolio:** E-portfolios are used for presenting skills and knowledge on a topic. Students can merge various presentations, images, text, audios, videos and links. An e-portfolio can also serve as a platform for topic wise discussions.
- **FLASH / DVD / CD-ROM:** DVDs with videos or multimedia content are vital part of many online courses. These DVDs can be used by students to review repeatedly the study materials offline and hence effectively distribute the time students will spend online. The various types of technologies used for synchronous and asynchronous technologies are shown in Table 1 below.

Table 1. Various synchronous and asynchronous technologies

E-learning technologies	
Synchronous communication	Asynchronous communication
✓ Chat	✓ Virtual libraries
✓ VoIP	✓ E-mail
✓ Web conference	✓ Forum
✓ Audio podcasts	✓ Social networks
✓ Virtual worlds	✓ Electronic portfolio
	✓ Multimedia content

3. Platforms Used for E-Learning

The two common types of platforms used for e-learning are communication platform and Learning Management System platform (LMS). Synchronous type of learning use communication platforms and consists of the aforementioned technologies as in table 1. The most widely used online teaching platforms are as under:

- **Zoom** is a dedicated platform used for conference calls. It provides services such as chat and meetings, video webinars, conference rooms, sharing of screen, recording of session and transcription. It integrates continuously with LMS, permits one-click sharing of content, real-time co-annotation and digital white boarding.
- **Microsoft Teams** is a form of digital hub. It brings discussions, content, assignments, and apps together at one place. It helps teachers to create vibrant learning surroundings. It offers designing collaborative classrooms, connect with professional learning communities and connect with various colleagues.
- **Discord** offers a specialized chat channel. It permits sharing of images, text, audio and video amongst various users in a chat channel.
- **Skype** is one of the widely used applications for chat and video calls. It provides services such as chat and video conferencing, creation of group, sharing of screen, sharing of files, documents sharing, photos sharing, call recording, phone call etc.
- **Messenger** application is portion of the Facebook platform, but can be deployed distinctly from it, only the account should be the same. The main features of this application are chat and video calls, allows sharing of screen, allows sharing of files, document sharing, photo sharing and more.
- **Viber** was initially designed for chat and phone calls. Now it provides installation on all devices. It provides services such as creation of group, chat and video calls, allows sharing of screen, allows sharing of files, document sharing, photo sharing, phone call and more.

Learning Management System (LMS) Platforms are a group of interactive online services used for designing, presenting, managing and using the learning content. There are also features for tracking, analysing and reporting the results saved. These systems automate the method of conducting distance learning and are a favoured tool for obtaining the educational goals of different types of institutions and organizations. The various LMS platforms are as under:

- **Google classroom:** This platform assists teachers to create and arrange assignments quickly. It also provides feedback proficiently. The teachers can easily communicate with their classes using Google classroom. It also helps students to arrange their work in Google Drive, conclude their work and turn it in and communicate straightly with their peers and teachers. It allows creating, sharing and editing of documents, conducting class tests, organizing various projects.
- **Moodle:** It offers training modules for creating, sharing and editing of learning materials, forums and file history

tracking, calendars, various notifications and tracking progress. It also provides modules for administrative management like creation of course, rights management, mass enrollment, secure authentication and more.

- **Vedamo:** It provides both a learning management platform and a classroom platform. It provides various functions for video-conferencing, online whiteboard, screen-sharing, break-out-rooms, media player and recording. The LMS platform Vedamo provides different features for course management, virtual sweet room, custom exams, cloud-based library, system reminders, user management, messaging and attendance.
- **Schoology** is an LMS platform which provides various features like calendar and tool for data analytics and personalized learning, set up mobile notifications, tools for creating courses and lessons, assessment management feature, set up different communications by in-platform messages and much more.

Both the types of aforementioned platforms are used in e-learning. Both these platforms complement each other and offer a healthier communication amongst the teacher and students. Most of the platforms permit integration with other platforms and educational tools existing on the internet. Nearly all the platforms provide applications that can be installed on various devices such as smartphones, laptops, tablets and PCs with different operating systems like iOS, Mac, Windows, Android, Linux and Unix.

4. Advantages and Disadvantages of Different E-Learning Technologies

One of the major advantages of all e-learning platforms and applications is that they offer compatibility with each other. The various e-learning platforms also offer flexibility of location for users as mobile versions have been created for most of the applications.

But during the pandemic time, e-learning platforms were overloaded with a huge number of registered and active users, because they were not organized to keep and manage the large number of newly registered user accounts with the novel learning content data.

The different e-learning platforms used and their merger with different tools permit great flexibility for preparing and presenting the study material through files, visual clips and with presentations. It could be a difficulty for teachers, but is a positive point for pupils and students, who can assess and study the provided material at any time and use the material for self-preparation.

The difficulty faced by teachers is in the beginning while creating the online material and verifying the same for authenticity, because it involves time and virtuous computer skills to work with various platforms and tools.

Generally, most platforms offer analogous modules, tools and services. The choice of e-learning platform depends upon a

well-constructed design and easy use of functions by the users. One of the major problems in implementing e-learning platforms is the necessity to train more teachers and then in creating the necessary e-learning materials.

5. Challenges of E-Learning

The major challenges of e-learning are as under:

- The advancements in e-learning technology and the digitalization of education are one of the major challenges for teachers. The teachers need to continuously monitor the modernization and enhance their competencies and skills [7]. The training regarding the usage of various e-learning platforms and online courses should be provided to the teachers.
- There are some difficulties and challenges in implementing e-learning applications in technical and natural sciences field. In these fields the execution of laboratory exercises requires direct contact with the lab instructor, specific equipment and various models for conducting the laboratory class [8]. A possible solution here is provided by the usage of virtual classrooms which includes simulations.
- The implementation of attendance monitoring system is also a major challenge in distance learning since it requires the essential equipment on both the sides along with the proper internet connection. There is a lack of computers, mobiles, tablets and other electronic gadgets in the underdeveloped countries and most of the world population resides in these countries. So, conducting electronic lessons and allocating homework assignments is still a big challenge in these countries.
- Some universities have their own websites for student monitoring, uploading the necessary materials, projects and more [10]. The challenge here is to integrate or adopt these systems with LMS.
- The possibility to create, maintain and distribute virtual laboratories is still a big challenge and difficult to achieve for all the streams.

6. Conclusions

The currently used information and communication technologies, newly developed platforms and applications for e-learning allow different users to successfully shift to e-learning paradigm. The various e-learning applications and platforms mentioned in the present work offer the essential functions and tools for creation, editing and presenting the educational content online. But for successful implementation of e-learning, the technological skill of teachers must be enhanced, which will confirm the accomplishment of educational goals. In the present work the most famous e-learning platforms and applications used during the pandemic time are explored. Some of the problems in implementing e-learning technologies in the present education system were also addressed in the present work. Finally, the challenges for future research and enhancement in e-learning practices were discussed and solutions were presented.

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