E-LEARNING SYSTEMS: A REVIEW

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***Abstract*—E-learning systems are gaining attention among academicians and students because of its time and location independence which provide learners a great flexibility of learning. Most of the e-learning systems are deployed using Internet. This paper describes various e-learning systems designed and developed by individuals, Institutions or universities to support learning process. E-learning platforms are then described. This paper also discusses various Massive Open Online Course (MOOC) platforms available on Internet and shows a comparative summary of their features.**

Keywords-E-learning systems; MOOCs; E-learning platforms; learning environments

I. INTRODUCTION

E-learning is the use of electronic technologies for the process of teaching and learning. There are various definitions of e-learning but all definitions overall describe the use of electronic media in the process of teaching and learning. K.H. Fee defines e-learning as any learning that involves use of internet or intranet [1]. The term e-learning comprises a lot more than online learning, virtual learning, distributed learning, networked or web-based learning. As the letter "e" in e-learning stands for "electronic", e-learning incorporates all educational activities that are carried out by individuals or groups working online or offline, and synchronously or asynchronously via networked or standalone computers and other electronic devices [2]. E-learning should not be viewed as one way communication. It brings challenges to instructors to understand students' perception on a course where no face to face communication takes place. Using feedback tool can play vital role to resolve this problem to some extent. Findings from a study carried out by M. Samir et al. states that Instructors need to understand their student motivations when teaching online classes. Allowing students to submit online assessment form can help teachers to identify and apply number of strategies to motivate students [3].

Blackboard Inc. described following advantages of online learning [4]:

- Enhancing student-to-student and faculty-to-student communication.
- Enabling student-centered teaching approaches.
- Providing 24/7 accessibility to course materials.
- Providing just-in-time methods to assess and evaluate student progress.
- Reducing administration around course management.

Other key advantages may include flexibility, time independence, location independence, easy communication, cost effectiveness and easy distribution of learning material. Joumana et al. mentioned that incorporating students' feedback in online courses will help teachers to keep track of students' learning [5].

This paper aims to study advancements in the area of e-learning. Section II contains review of related literature followed by a summary in tabular form. Section III describes various popular e-learning platforms available in the market. A new form of teaching learning process, Massive Open Online Courses (MOOCs), is discussed in section IV.

II. LITERATURE REVIEW

E-learning systems have been implemented in different forms with different objectives. This section covers study of various learning management systems.

The University of Maryland University College (UMUC) has developed its own learning management system (LMS) called Tycho, especially for IT professionals. Starting from a text based DOS application it has now evolved into a standard web based interface called WebTycho. Being one of the largest public universities in US, UMUC registered over 94000 students from 27 countries till 2011. The advantages of the LMS include distance and time independence, easy access to current information and technology and increased interaction between students and instructors. Various tools were used to conduct immersive group projects and educational tours, just-in-time guidance and experience sharing, collaborative and reflective presentations, virtual internships and interactive sessions [6].

Timothy K. Shih et al. worked on a project **Hard SCORM** using Sharable Content Object Reference Model, which allows readers to read SCORM compatible textbooks using ubiquitous devices. The project includes a pen like device to scan characters of physical textbook and generate an electronic version of the book with interactive contents using authoring

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tool. The SCORM compatible textbooks can be incorporated with audio, video, URL and flash animation references which may be linked to internal or external resources. The XML-based web service architecture HARD SCORM also facilitates to evaluate learners using quiz test [7].

Mohamed Hamada designed an integrated virtual environment (IE) tool to support active and collaborative e-learning for computer engineering learners in theory of computation course. This web based java application is bundled with rich hypertext course content, finite state machine simulator, turing machine simulator, animated videos and visual examples and a chat component to support collaborative learning [8].

Handwritten notes have advantages of enhancing capability of remembering information. Keeping this view in mind, a platform called PenLearning is developed which allows learners to take lecture notes in digital form, store it and manage it using learning platforms like Moodle and Google Docs. It also offers services like real time collaboration with other learners and self assessment. A survey revealed that the platform was found much useful for document management and collaborative editing for its users [9].

An experiment was conducted by Luisa M. Regueras et al. to study the effect of competitive learning (in combination with collaborative learning) on the satisfaction and academic achievements of undergraduate telecommunication students using a software tool QUEST for "Communications Networks" course. Students can resolve challenges submitted to a web based tool, in a time constraint where scores are awarded based on the time order of correct answers submitted. The final scores obtained by students depend on both the score of the challenge at the time it is answered and on the result of the assessment carried out by the author of the questions. When a challenge is expired, students can view summary report containing scores obtained by all students [10].

The University of Economics, Prague (UEP) uses a computerized progress test to be taken in the middle and at the end of semesters. The university introduced e-learning tools in form of pilot version only on certain topics of Law Basics course to examine the influence of provision of e-learning tools to the progress tests results of students [11].

Christos Troussas et al. used an e-learning system called "Comulang" that supports collaboration in a multiple language learning platform. With the aim of providing efficient student groups whose limitations and capabilities are well balanced, a machine learning clustering algorithm was used to form groups. The system was already presented to a small group of tutors and a large group of students who found it interesting and promising towards the creation of successful distance learning courses [12].

Table1 summarizes objectives and outcomes of the above reviewed literature.

III. E-LEARNING PLATFORMS

A large number of open source and proprietary e-learning platforms are available which can be adopted by any educational institution. These platforms also allow integrating customized modules to it to meet personalized requirements of educational institutions. This section reviews such e-learning platforms.

A. Moodle

It is an open source web based e-learning platform. Its major features include collaborative tools and activities, file management using cloud storage services, private and broadcast messaging, progress tracking, mass enrollment, multi lingual capability, bulk course creation, high interoperability, detailed reporting and logs, design and management of courses, content driven collaboration, peer and self assessment and integrating multimedia and external resources [13].

B. Blackboard/WebCT

Blackboard Inc. offers platforms such as Blackboard Learn, Blackboard Collaborate, Blackboard Connect, and Blackboard Mobile to provide innovative services with virtual learning environment, real time collaboration, urgent community communication and learning on hands [14].

C. Sakai

Sakai is an open source learning management system that provides a flexible and feature-rich environment for teaching, learning, research and other collaboration developed as a result of open source project Sakai by Apereo Foundation [15].

D. SUMTOTAL LEARN

It is a real time learning management system developed to expand skills of human resource professionals. Immediate response, exclusive focus on human resource management, easy to learn environment and deployment choices are key components of this proprietary software solution [16].

E. ATutor

ATutor is a free open source learning management system used to develop online courses and create e-learning contents. It provides varieties of features to learners, teachers and developers to customize their learning environments [17].

F. Brightspace by Desire2Learn

Higher education and K-12 education are the target markets of Brightspace solutions offered by D2L. These solutions include online and blended learning, curriculum management, content management and analytics [18].

G. Learning.com

Learning.com provides various tools to seamlessly organize access and share digital contents. They provide solutions to help schools, teachers and students excel in digital world. Its popular products include EasyTech, Project NextTech, Curriculum Foundary and many more [19].

TABLE I – SUMMARY OF DIFFERENT RESEARCH PAPERS REVIEWED

Sr	Paper Title with Year	Methods/Techniques/Tools	Objective/Research Findings/Outcomes
1	E-learning for IT Professionals: The UMUC Experience (2011) [6]	Tools: Twibes, Second Life, Google Docs, Batch Geo, Dropbox and WebEx	**Objective:** To review e-learning efforts at The University of Maryland University College (UMUC) **Conclusion:** With interactive, visual and engaging environment, students can be attracted and retained by the institutions.
2	Ubiquitous e-Learning with Multimodal Multimedia Devices (2007) [7]	Method: Sharable Content Object Reference Model (SCORM), Web Service Architecture Languages: XML, Java Tools: ECMAScript API	**Objective:** To develop and evaluate a learning management system based on SCORM **Results:** Learners agreed that using SCORM textbooks facilitated exploring the associated multimedia learning resources and improved the learning performance.
3	An Integrated Virtual Environment for Active and Collaborative E-learning in Theory of Computation (2008) [8]	Method: Keller's ARCS motivation model Language: HTML, Java Tools: Finite State Machine Simulator, Turing Machine Simulator Technology: Java2D	**Objective:** novel use of existing technology to improve learning and a longitudinal quasi-experimental evaluation of its use in context **Results:** Developed visual tools can enhance learner's motivation and performance. The integrated tool and its components are useful for supporting collaborative online e-learning in a variety of courses.
4	An E-learning Platform for Integrated Management of Documents Based on Automatic Digitization (2013) [9]	Language: Java Technology: Java Enterprise Edition (JEE), Enterprise Java Beans (EJB), Java Server Faces (JSF), Rich Faces, Windows Communication Foundation (WCF) Tools: JBOSS, IIS, MOODLE	**Objective:** To present an e-learning platform called PenLearning, that combines the traditional method of note taking with digital documents and identifying its benefits compared to other similar methods **Results:** PenLearning platform proved to be better alternative to take lecture notes and also found effective. Users were satisfied with the functionalities of the platform.
5	Effects of Competitive E-learning Tools on Higher Education Students: A Case Study (2009) [10]	Tools: QUEST, phpEsp	**Objective:** To study the effect of competitive learning along with collaborative learning on satisfaction and academic achievements of undergraduate students using QUEST e-learning tool **Results:** The study concluded that the use of competitive active e-learning tool such as QUEST has important effects on learning habits of students. Level of satisfaction with this e-learning tool was positively evaluated by students and also helped them to achieve better final exam grades
6	The Influence of Using E-learning Tools on the Results of Students at the Tests (2015) [11]	Method: Survey using Questionnaire	**Objective:** To examine the influence of provision of e-learning tools to the progress tests results of students **Results:** The provision of the e-learning tool for students has got positive influence on their results at progress test
7	Comulang: Towards a Collaborative E-learning System that Supports Student Group Modeling [12]	Method: A machine learning clustering method to form groups	**Objective:** To describe an e-learning system to enhance the educational process in computer based tutoring systems by incorporating collaboration between students and work in groups and to provide efficient student groups whose limitations and capacities are well balanced.

IV. MASSIVE OPEN ONLINE COURSES (MOOCS)

Massive Open Online Course (MOOC) is an open access platform where any student having an internet connection can enroll for an online course. The method of delivering learning material is video lectures, usually of 8-15 minutes, designed with keeping student's view in mind [20]. Most of the courses offered are free and can prove as a critical medium to provide education in remote areas where enough expertise is not available.

A. edX

edX offers interactive free online classes and MOOCs with innovative video learning contents from the world's best universities like MIT, Harvard, Berkley, UTX and many others [21].

B. Coursera

Coursera is an education platform that partners with top universities and organizations worldwide. It typically provides immediate feedback on points student didn't understand. Many institutions have incorporated courses offered on coursera in their curriculum to provide blended learning to students [22].

C. Udacity

Udacity focuses on providing courses based on skills required by industries. Nanodegree programmes offered on this platform are co-created by industry giants such as Google, Facebook, AT&T, mongoDB, Twitter, NVIDIA, Amazon web services and others [23].

D. MEC

Massively empowered classroom is a community initiative by Microsoft research. It is a research project designed to bring the highest quality classroom material to every undergraduate engineering student in India [24].

E. FutureLearn

FutureLearn is providing free courses for everyone in the area of language, culture, business, management, science, technology, health, psychology and many more [25].

F. Canvas Network

Canvas Network focuses on easier learning for higher education, K-12 and workforce users. It is developed with open, adaptable, reliable and native cloud technologies by Instructure Company [26].

The following table describes features of the above mentioned e-learning environments.

TABLE II – SUMMARY OF FEATURES SUPPORTED BY VARIOUS E-LEARNING PLATFORMS

	edX	Coursera	Udacity	MEC	FutureLearn	Canvas Network
1. Learning Methods						
Video with audio	√	√	√	√	√	√
Audio only	×	×	×	×	√	×
Articles	√	√	×	×	√	√
Projects	×	×	√	×	×	×
Discussions	√	√	√	√	√	√
2. Assignments	√	√	√	√	√	√
3. Quiz Tests	√	√	√	√	√	√
4. Transcripts	√	×	√	×	√	×
5. Video with interactive transcripts	√	×	×	×	×	×
6. Certificate	√	√	√	√	√	√
7. Peer Assessment	×	√	×	×	×	×
8. Adaptive Learning	×	×	×	×	×	√
9. Course joining timings	-Scheduled -Anytime	-Scheduled -Anytime	-Scheduled -Anytime	Anytime	Scheduled	Scheduled
10. Target Users	Anyone	Anyone	Professionals	Anyone	Anyone	Anyone

V. CONCLUSION

E-learning definitely helps student to improve their performance. Different learning environments have their own way of implementation of such systems. Technological developments have made it easier to develop customized learning solutions. The review experienced that the recent developments are more focused on adaptive and personalized e-learning environments. E-learning platforms can be adapted by institutions to enhance teaching learning process. One major footstep in this area is MOOC which provide quality e-learning from eminent experts without any cost. This review shows that educational material is made handy with emerging technologies to everyone who needs it. Professionals and students, who are not in situation to attend classes at a specific location on daily basis, could find e-learning as a great opportunity to enhance their knowledge and skills. Comparative study of various MOOC platform shows that most platforms are designed in such a way that they mimic the traditional features of pedagogy in electronic form.

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