E-learning and Adaptive E-learning Review

Jehad Hammad † and Mochamad Hariadi ††, Mauridhi Hery Purnomo ††, Nidal Jabari †††, Fachrul Kurniawan††††

† Department of Computer Engineering Institut Teknologi Sepuluh Nopember (ITS) Surabaya, Indonesia

† Faculty of Technology and Applied Sciences, Al-Quds Open University, Palestine

† † , Dept. of Electrical Engineering, Institut Teknologi Sepuluh Nopember, Surabaya, Indonesia

† † † Department of Computer, Palestine Technical University (Kadoori), Arroub, Palestine

† † † † Department of Informatics Engineering, Universitas Islam Negeri Maulana Malik Ibrahim Malang

Summary

This paper presents a brief overview of the e-learning concept, e-learning history, technology and future, Virtual Classes, adaptive e-learning and case study. The development in the cyber learning is being so rapid in these systems. The features of adaptive learning are emphasized by comparing it with the other e-learning systems. It is clear from the paper that adaptive learning has various aspects and will lead to a new era in learning. Using the best suitable e-learning tool depends on the learning group and the space of learning. Adaptive learning enhances the learning ability by customizing the learning objects to the student needs and mapping it directly to the learning domain.

Key words:
Adaptive E-learning, Blended learning, E-learning, Online learning, Virtual classes.

1. Introduction

During the last few years e-learning has been one of the interesting research fields. It is growing fast and many people, organizations, companies, and universities have started to use it [19][8]. This paper presents a brief overview of the field of e-learning. It introduces the concept of e-learning, the history of e-learning, the benefits and drawbacks of online learning, the future of e-learning, types of learning management systems, and synchronous e-learning vs. asynchronous e-learning, and technologies used in e-learning. Also it introduces different types of learning including blended learning, social and collaborative learning, and micro-learning. It also discusses the virtual classroom concept and components, especially the online presentation, and direct meeting. The last part of this paper will describe the adaptive e-learning concept and its background including the Domain Model, Student Model, and the Adaptive Model.

2. E-learning

2.1 What is E-learning

For many years until the early centuries, education was a group of students in a traditional classroom with teacher who led the teaching process. The learning landscape changed after the computer evolution [9]. The e-learning concept means all the computer based educational tools or systems will allow the learners to get their education anytime and anywhere. In the past the e-learning used the CD-ROM, and the other blend of computer-based methods. Nowadays the Internet has become the main method for delivering e-learning [24]. The advanced improvements of technology, especially the networks and the internet, bridges the geographical gap by using tools that make the learners feel as though they are inside the classroom. e-learning offers the ability to share different kind of materials such as PDFs, word documents, slideshows, and video, as well as the ability to conduct online virtual classes that allow the participants to ask questions using the voice and the chatting tool[9]. Many different e-learning methods and systems were found and are known as Learning Management Systems (LMS), which deliver the courses. These systems provide good, different services and tools, including the creation of engaging content, and automated marking of tests. The learners in the e-learning have the ability to fit learning around their style of life and it gives many people the opportunities to get a new career by gaining new qualifications with flexible ways. Since the launch of the Internet, the most important developments in education are been evaluated. The use of smart phones, text messaging, and using the internet running an online course has become simple and very common. Social media and electronic media and various other means of online communication allow learners to keep in touch and discuss courses related to their needs and requirements in the community [9].

In the fast moving world of today, e-learning technologies are used to make a course exciting, entertaining, and challenging In the fast moving world of today, e-learning technologies are used to make a course exciting, entertaining, and challenging. Course content must be updated quickly to give students the very latest information. In e-learning training emphasis is given to employees in a sector where keeping up-to-date on industry developments is of the utmost importance. This is why many businesses are now offering training via e-learning - other reasons includes low costs and the ability for employees to study in their own time and place. E-learning offers a faster, cheaper and potentially better and alternative mode of learning to the learners in a flexible time and place.

2.2 The History of E-learning

The term "e-learning" has been known since 1999, when it was first utilized at a computer based training systems (CBT) seminar. Other words used to describe e-learning such as "online learning" and "virtual learning" existed earlier in the 19th century. Distance education courses were being offered to provide student's education on specific subjects [9]. In the 1840s Isaac Pitman taught his pupils shorthand via correspondence, which was the first distance course experience. The secretaries, journalists, and other individuals used a symbolic writing system designed to improve writing speed and note taking or writing. Pitman, who was a qualified teacher, mailed and sent his students more work to be finished using this symbolic system. The first testing machine was invented in 1924. This device allowed students to test their writing skills by themselves. Further in 1954, BF Skinner, a Harvard Professor, invented the "teaching machine", which was a big achievement to help the schools to administer programmed instruction to their students in the school. In 1960, the first computer based training program was introduced to the world. This computer based training program (CBT) was known as Programmed Logic for Automated Teaching Operations (PLATO). It was originally designed for students attending the University of Illinois, but was only specified for school work [9].

In the 70s e-learning started to become more interactive in other industries besides education. In Britain the Open University took advantage of e-learning for distance courses. Their system of education has always been primarily focused on learning at a distance.

In the past, course materials were delivered by post and correspondence with tutors was send via mail by the teachers of Open University. Because of the internet the Open University became popular as faster correspondence was available to students via email and other modes of e-learning available at that era.

2.3 Online Learning Today

In the late 20th century, e-learning tools and delivery methods become very common. In 1980′s people had computers in homes, and it was an easy way to learn about particular subjects and develop certain skill. By this way virtual learning began to truly thrive, with people getting access to online information and e-learning opportunities. In the early 90s several schools offered online courses, making the most of the internet and bringing education to people via internet and e-learning. An advancement in technology also helped the education system to reduce the costs of distance learning, hence making e-learning economical to the students [2]. With the start of the 21st century, e-learning started to be used in business to train their employees and workers, to improve industry knowledge, and to create skillful workers. By this way online degrees are provided to the people at flexible places, and time. It made their lives easier through expanded knowledge.

2.4 The Benefits of Online Learning

E-learning packages offer a lot of benefits to different people, like the teachers, who want to engage their students in an interactive way, or large companies who want to offer good training to their employees with low cost and high quality. Below is the outline of some important benefits of the e-learning:

- No Boundaries, or No Restrictions: In traditional learning the teachers and the learners faced the challenges of the restrictions of the location and time. Face to face learning limits the attendance to learners who have the ability to participate in the area, as well as the specific time to attend the class. On the other hand, e-learning meets these challenges by offering the learning for the people any time and any place. Any interested individual in any course can get it [9].
- More Fun: The courses in the e-learning are designed in an interactive way that includes the fun of using different methodologies and technologies, like the multimedia and the games which enhance the engagement.
- Cost Effective: E-learning has a low cost compared with the cost of the traditional learning materials, like textbooks, which need to be updated after a short period of time. It costs more money for, teachers, students, and schools. In e-learning the learning materials are usually updated easily, so the need to get updated versions is readily available in e-learning.

2.5. The Future of E-learning

 E-learning has become more common and accessible in today's world as computer, laptop, I-pad, I-tab ownership is growing across the globe. Increasing Internet speeds,

opportunities for more multimedia training methods has also increased. In the past few years, improvement in mobile networks, advancement in telecommunication, smart phones and other portable devices are using the features of e-learning. Social media is also playing a vital rule in education. Generally, e-learning is time consuming, takes a long time and the results can vary. E-learning takes years to be measurable and accessible in an effective way. Different tools can help to create interactive courses, standardize the informal and formal learning processes, depending on the needs of users, and the tools are helpful for future modification and trending of user's requirements. The design of micro-learning activities through micro-steps in digital media environments is based on micro-learning, which is a daily reality for today's workers and are used in learner's daily routines and activities. Micro learning often uses technology based media, which reduces the cognitive load on the learner's learning approaches and accessibility. So, the selection of objects and timing of micro learning activities are important for didactical designs. Micro-learning doesn't need to have separate learning sessions because the learning process is scheduled in the daily routine of the end-user. Micro learning is nowadays being used in cell phone and other smart devices of today's era. The use of game thinking and game mechanics in a non-game context to engage users and solve problems is called Gamification [9].]. Personalized Learning is the tailoring of pedagogy, curriculum and learning environments to meet the needs and aspirations of individual learners as being required in their daily activities with a schedule[2]. Personalization is broader for individualization or differentiation in that it affords the learner a degree of choice about what is to be learned, when it is to be learned, and how it is to be learned.

This doesn't mean the unlimited choice as learners will still not have targets to be met, but it provides learners the opportunity to learn in ways that suit their individual learning styles, multiple intelligences, and flexible places and times.

2.6 Synchronous E-learning vs. Asynchronous E-learning

There are two categories of e-learning in today's world: synchronous and asynchronous. Both have their own pros and cons, and the technique used by the student depends upon their method of taking and understanding the information that is being provided [28][2].

- What is synchronous learning?

Synchronous e-learning is online chat and videoconferencing. For example, instant messaging that allows students and teachers to ask and answer questions immediately, is synchronous [3]. Participants in synchronous learning courses are able to interact with other students and their teachers during the lesson [4],[9]. The synchronous learning is used by the students because it enables students not to feel isolated or alone as they are communicating with others throughout the learning process [19]. However, synchronous learning is not as flexible in terms of time as students would have to set aside a specific time slot in order to attend a live teaching session or online course in real time. So it is not suitable for the students with busy schedules[2].

- What is asynchronous learning?

Asynchronous learning can be utilized when the student or teacher is offline and it is flexible with respect to timing. Web, and email are two of the best examples of delivering course materials to the students in asynchronous e-learning. In this mode of learning students complete the lessons by themselves by the use the internet, rather than being online for classes [10]. The student can find the lessons at any possible time and complete the work and assignments. By this way the students can enjoy the time flexibility and can complete the task at any time. However, one of the drawbacks of this e-learning is that the students don't have direct interaction with other students and teachers [25]. Asynchronous learning can also lead the student to be isolated and there is no direct communication with other students and teachers, and it doesn't provide the educational environment like in synchronous learning [10], [9]. Both asynchronous and synchronous learning are the effective ways of e-learning with its pros and cons included in both. These modes of e-learning benefit students and teachers regardless of their schedules or preferred learning methods. It is a kind of immediate needed help, while still giving them the ability to learn at their own place with flexible timing. Figure 1. Shows the Synchronous and Asynchronous learning technologies and classifications [9],[10].

2.7 Blended learning (BL)
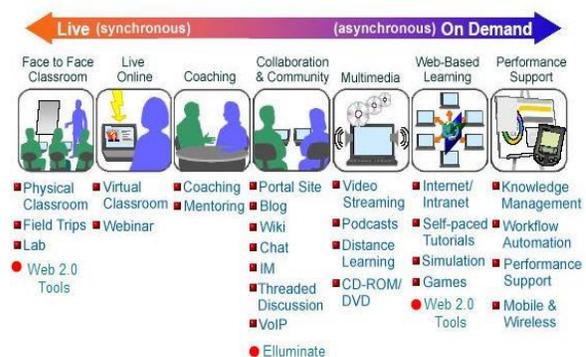
Fig. 1 Synchronous and Asynchronous learning technologies

The combination of face-to-face and traditional learning is called Blended Learning (BL) [26] that means using the online learning in addition to the offline traditional way of learning. Based on this concept each type of it is a compliment for the other. Using Blended learning gives the learners the opportunity to enjoy and gain the best advantages of both of them. The students of the Blended learning can attend the face to face sessions in classroom and they can use the e-course which includes multimedia coursework, lesson plan, and assignments. In such type of education the students have to attend the class once a week, and they will be free to go on their own pace without caring about the scheduling [11],[9].

Blended learning is also named "hybrid" learning. It can use many types of online education platforms. Using of it depends on the organization, and some organizations use it as a primary teaching method within the curriculum, and others just use it in some specific cases [11],[9]. Blended learning needs two factors to be successful. The first one, students who can use it in a correct way by sharing the work and the information in a collaborative method; in this case the students will enrich their learning experience. The second factor is the group activities to improve the collaboration between students.

Also in some organizations they follow the online courses with face-to-face class activities to enrich their educational experiences.

Blended learning needs a Learning Management System (LMSs), mobile devices like smart phones, and tablets [11],[9]. The structure of Blended learning is shown in Figure 2 [10].

2.8 Virtual Classes
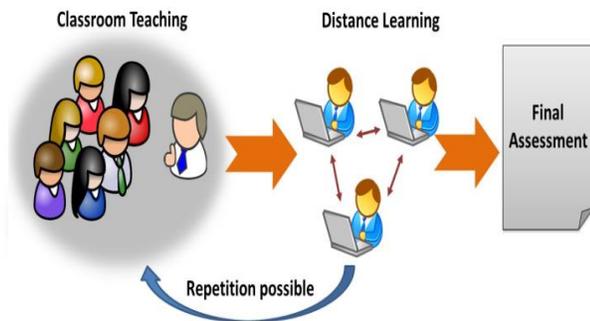
Virtual classes are one of the modern tools for e-learning that uses the Synchronous type of education threw the web. It offers many services for both the teachers and the students at the same time including Live Video Streaming Application, files and desktop sharing, instructors can view each student's session, Public and private text chat, Offers Anytime Access, Ensures Comprehension, Electronic whiteboard and polls, quizzes and surveys, flexible content area, recording of the class, access to persons with disabilities, and application sharing [22][12].

 - Advantages: The virtual classroom offers some advantages over the traditional class room including the following[7]:
• Removal of geographical barriers (Anywhere learning)
• Sessions can be recorded
• Quicker to organize
• One to one communication

- Common Virtual classes software: Much virtual classroom software has been created in the last few years. Table I. shows some of the common once including the website address where you can find more details and information [7],[13].

3. Adaptive E-learning

In the last few years, the information technology for education has been switched to e-learning systems. E-learning systems have been strengthened by the World Wide Web (WWW) and the Internet. Combining the use of the internet for teaching and learning methods has introduced a new era of opportunities and challenges in the distance education system. E-learning is delivering major educational material to the learners and distance education seekers[14]. Adaptive e-Learning is a new approach which is an effective tool by adapting the learning materials and all linkage structure to users related to their knowledge and behavior [23],[14].

Fig. 2 Structure of Blended learning

Table 1: Virtual Classroom Software

Organization	Product	Website
Blackboard Inc.	Blackboard application Suite -Virtual Classroom/Collab-oration Tool	WWW.blackboard.com
IBM Lotus	IBM Lotus Virtual Classroom	WWW.lotus.com
WebEx	Training Center	WWW.webex.com
Web Train	Web Train Online Education	WWWwebtrain.com
Microsoft Research	ConferenceXp	cct.cs.washington.edu/downloads/CP/
Interwise Inc.	ECP Concept	WWW.interwise.com

Each individual learner with different learner-characteristics and different levels of approach to Adaptive e-learning has different education abilities which varies from learner to learner, according to their level of knowledge, interaction, and skills [15]. The Adaptive e-learning system can deliver the course content in a flexible way, so that it gets the best learning result. An adaptive system works on the student model, and approaches the learner's characteristics to optimize the learning outcome [16],[17],[18]. The adaptive e-learning system aims to keep track of usage and to accommodate content automatically for right student, assumption and knowledge. This student model is adapted for the interaction of the e-learning system according to the user's demands [16],[17]. E-learning systems can be more effective using adaptive e-learning systems which will improve the students skills and knowledge.

3.1 Background on Adaptive e-learning

The teaching and learning adaptation can be divided in four parts as described below [19].
- Adaptive content aggregation: The adaptive teaching and learning style can provide the students with different content depending on simulations or games. Further, page information can be aggregated by unique background knowledge and approach levels of multimedia.
- Adaptive presentation: The presentation in the page can be adapted by prerequisite, additional, or comparative explanations. The explanation means that the same page content can be displayed in different ways and follow the relevant background knowledge to the student's approach.
- Adaptive navigation: The navigations presented within the pages can be adapted to achieve several adaptation goals.
- Adaptive collaboration support: This method uses a network-based educational system using the system's

knowledge which is provider communication between users with the collaboration application[20].

3.2 Sense-Making Methodology

Adaptations in learning environment are based on well-organized models and processes which can be divided into three main models: a domain model, a student model, and an adaptive model.

4. Discussion

During the last few years e-learning has become common in many universities and companies, because of the rapid development in the computer technology, Internet high speed, and mobile devices. These give the learners the opportunity to gain the benefits of the e-learning. Many e-learning technologies and types including the Synchronous and the Asynchronous have become common in use by many learners, universities, and companies. Many e-learning platforms have been created to offer e-learning courses, and we can find many universities collaborating to offer some of their courses on it. Based on the literature review, we can summaries the main difference between e-learning and adaptive e-learning as shown in the Table 2.

Area	E-Learning	Adaptive E-learning
Learning Content	The learning content is presented and delivered to the learners without customization to meet or adapt their requirements.	The learning content delivered in a customized and adaptive manner to meet the requirement of the learner and this is the main objective of an adaptive e-learning system.
Categories	Asynchronous (on demand) or Synchronous(live)	Asynchronous (on demand)
Nowadays use	The e-learning systems have become commonly used by many universities and companies. In the last few years many e-learning platforms were founded and many Universities around the world cooperate and offer their courses on it. Two of the popular platforms used today are coursera (www.coursera.org), and edx (www.edx.org). We can say that we are in the era of the e-learning, for example research shows that in 2004 over 90% of public institutions in the USA offered a few e-learning courses [1].	Some adaptive systems have been developed but it is still not in common use compare to the standard e-learning. Adaptive learning systems can be implemented and used in group collaboration and distance learning [2]. Nowadays in the distance learning, the trend is to use adaptive learning by develop intelligent dynamic behaviour in the learning environment. The University of RMIT in Australia, developed one of the most successful adaptive learning implementations in the web-based distance learning system which is "Maple engine of WebLearn".[3]
Technology, Popular tools, and examples	Many technologies have been used in the e-learning field and it based on the e-learning categories. Synchronous learning may use technologies such as virtual classrooms or chat rooms, Skype conversations, online real-time live teacher instruction and feedback. On the other hand the technologies used by Asynchronous learning are blogs, discussion boards, email, wikis, web-supported textbooks[65], hypertext documents, audio, video courses, social networking using we2.0,Podcasts, and simulation[4].	Traditionally, the systems of adaptive learning have been divided into separate models or components, Usually it includes the Expert model, Student model, Instructional model, and Instructional environment [5]. The Popular development tools for the Adaptive e-learning includes: Adobe Captivate, Articulate Storyline, and the advance ones are Skilitics Interact, and Domoscio. The first adaptive learning system was "SCHOLAR system that offered adaptive learning for the topic of geography of South America" [6]. One of the good examples for the Adaptive implementation is "Maple engine of WebLearn".

Because of the fact that learners come to any course from different backgrounds and previous knowledge, actually was a big challenge for the standard e-learning, because it didn't adapt the e-learning to meet the requirements of the learners. In standard e-learning all the learners get the same experience [2]. In the case that some of the learners already know the subject, they will start to feel bored. From this point the idea of the adaptive education came as the best solution for this problem. By personalized e-learning, the learners can engaged with the content of e-learning. In the adaptive e-learning the system will gather information about how much the learner knows about the subject, and the learners will focus on the area that they need. In 1970 the adaptive learning or what was called Intelligent tutoring was founded after the Artificial-Intelligence field became popular, and the basic idea behind it was to make the system or the learning tools adjust to the learner's learning method [2]. One of the tools that has been used in e-learning is the Virtual classes, which provide online Synchronous learning.

Virtual classes offer many advantages over the others systems, but it also has some limitations, like the lack of socialization, lack of structure, lack of practical learning, technology issues, and also technical issues like bandwidth, speed of the connection which may cause problem for the ongoing class [7].

5. Case Study: Al-Quds Open University, Palestine

In Palestine, Al-Quds open University(QOU) is considered a leading University in using the E-learning. Implementation of the E-learning started in 2008 with a noticed continuous growth till today. In early stages, QOU implemented different blended models using Video streaming(VS), learning management system (MOODLE) and virtual class technology. In 2009 QOU started a pilot E-learning zone which consist of three University branches to apply the e-learning system on it. In this phase 30% of the curriculum that are more than 150 courses, were offered using blended learning system, based on this system half of the teaching sessions offered face to face and half of them offered by the online E-learning system using the models mentions above [27]. QOU redesigned its courses to be convenient with the new trends , at the same time it trained the academic staff to enable them to develop appropriate courses for delivery In a blended environment. However, some obstacles and difficulties were encountered in many aspects; such as college readiness, weakness of ICT infrastructure and lack of technical support. QOU also faced some resistance from

stakeholders especially in the change of the educational methodology at the university ,but the university conducted many researches in this field to solve these obstacles.

Generally QOU applies four educational models for e-learning based on five technologies to serve blended learning, that are:

• Virtual Class (VC).
• MOODLE: Learning Management System (LMS).
• OLAT: Content Management System (CMS).
• Video Streaming (VS).
• QOU's Web-Based Academic Portal (AP).

These technologies are used for e-Assignments Model , e-Activities Model , Video Streaming Model , and e-Course Template Model .

In Figure 3, the blended learning models at QOU are described. [27]

	Blended Model I		Blended Model II		Blended Model III
Delivery Method	Face-to-Face		Video Streaming (VS) & Face-to-Face		Virtual Class (VC) & Face-to-Face
Content and Material	Textbook		e-Course Template & Textbook		e-Curriculum & Textbook
Formative Evaluation	e-Assignments (exam, quiz, discussion forum, essay, or presentation) LMS: MOODLE Interface: Academic Portal				
Summative Evaluation	Mid-Term Examinations & Final Examinations In classrooms				

Fig. 3 Proposed blended learning models at QOU

In 2016, QOU brought the new educational environment to life through the announcement of self-learning open online courses (sLOOC) that aims to provide open access courses with the self-learning strategy, and to be published as an open educational resource (OERs) to all learners around the world in order to[28]:

• Enhance learning outcomes
• Increase the opportunities of learning and lifelong learning.
• Meet the learning styles of the digital natives.
• Keep up with the high demands in learning enhanced ICT.
• Promote the 21st century skills

In QOU, sLOOC so far is designed and implemented based on six principles [28]:

Content Modularity , Diversity of Learners , Content Interoperability , Open Accessibility , Engagement and Collaboration. sLOOC Structure is shown in Figure 4.

6. Conclusion
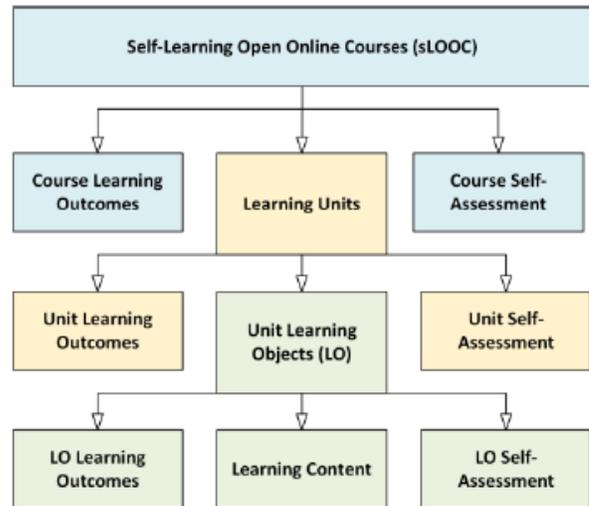
Fig. 4 sLOOC Structure

Many aspects of e-learning or online learning were considered in this paper. These aspects give a strong vision for the usage of learning by the different medias. Using e-learning surely enhances the ability of learning but also depends on the learning environment. A good definition of the target learning society is highly important, when we determine the e-learning tool we should use. International organizations which offer learning services on their web sites offer the learning objects in the same way for all users regardless of their traits and moreover their knowledge. Knowing more about the target group is important in order to build the learning materials.

When we use normal e-learning systems or blended learning we don't put much concentration of the student bio-data. However when we emphasize using "one to one" methodology, we must build the student model, which is related directly to the domain model, to build the adaptive model. These three models give the possibility to customize the learning objects to the student needs.

The adaptive learning, as we described in the table pre-discussed in this paper, has many differences from other learning tools. In the new era of e-learning systems this methodology of education will enhance the ability of learning by students and enhance the ability of offering the learning systems by organizations, but this is not very easy. The organizations must follow complex work in order to build the adaptive learning tools. Highly skilled technicians should be available to build these systems. Finally the organization will raise the performance in teaching material's production and delivery.

References

[1] Z. Wan, Y. Wang, and N. Haggerty, "Why people benefit from e-learning differently: The effects of psychological processes on e-learning outcomes," Information & Management, vol. 45, pp. 513-521, 2008.

[2] J. D. Basham, T. E. Hall, R. A. Carter Jr, and W. M. Stahl, "An operationalized understanding of personalized learning," Journal of Special Education Technology, vol. 31, pp. 126-136, 2016.

[3] N. E. Aguilera, G. Fernandez, and G. Fitz-Gerald, "Addressing different cognitive levels for on-line learning," in ASCILITE, 2002, pp. 39-46.

[4] I. Loutchko, K. Kurbel, and A. Pakhomov, "Production and delivery of multimedia courses for internet based virtual education," in The World Congress" Networked Learning in a Global Environment: Challenges and Solutions for Virtual Education", Berlin, Germany, 2002, pp. 79-96.

[5] C. P. Bloom and R. B. Loftin, Facilitating the development and use of interactive learning environments: CRC Press, 1998.

[6] J. R. Carbonell, "AI in CAI: An artificial-intelligence approach to computer-assisted instruction," IEEE transactions on man-machine systems, vol. 11, pp. 190-202, 1970.

[7] P. Mondal, S. Misra, and I. S. Misra, "A low cost low bandwidth real-time virtual classroom system for distance learning," in Global Humanitarian Technology Conference: South Asia Satellite (GHTC-SAS), 2013 IEEE, 2013, pp. 74-79.

[8] K. DelVecchio and M. Loughney, "E-learning concepts and techniques," Book E-Learning Concepts and Techniques, Series E-Learning Concepts and Techniques, Institute for Interactive Technologies, Bloomsburg University of Pennsylvania, USA, 2006.

[9] L. Epignosis, "E-Learning Concepts, Trends, Applications," ed: Version, 2014.

[10] "Synchronous and Asynchronous learning Technologies and clasifecations," in https://small-changes-big-returns.wikispaces.com/Blended+Learning, ed: Copyright 2016 Tangient LLC, 2016.

[11] "Structre of Blended learning," in http://www.elmmagazine.eu/articles/boosting-blended-learning-quality, ed. Europe: European lifelong learning magazine, 2016.

[12] D. N. Jain, "Virtual Classroom (VCR)," access on, vol. 4.

[13] kiseducationcenter, "Black Board main interface," ed, 2015.

[14] V. Esichaikul, S. Lamnoi, and C. Bechter, "Student modelling in adaptive e-learning systems," Knowledge Management & E-Learning: An International Journal (KM&EL), vol. 3, pp. 342-355, 2011.

[15] L. J. Cronbach and R. E. Snow, Aptitudes and instructional methods: A handbook for research on interactions: Irvington, 1977.

[16] P. Brusilovsky, "Adaptive hypermedia: From intelligent tutoring systems to Web-based education," in Intelligent Tutoring Systems, 2000, pp. 1-7.

[17] P. Brusilovsky and C. Peylo, "Adaptive and intelligent web-based educational systems," International Journal of Artificial Intelligence in Education (IJAIED), vol. 13, pp. 159-172, 2003.

[18] V. Shute and B. Towle, "Adaptive e-learning," Educational Psychologist, vol. 38, pp. 105-114, 2003.

[19] F. Mödritscher, V. M. García-Barrios, and C. Gütl, "Enhancement of SCORM to support adaptive E-Learning within the Scope of the Research Project AdeLE," in proceedings of E-Learn, 2004.

[20] L. Dall'Acqua, "A model for an adaptive e-learning environment," in Proceedings of the World Congress on Engineering and Computer Science, 2009, pp. 20-22.

[21] A. Paramythis and S. Loidl-Reisinger, "Adaptive learning environments and e-learning standards," in Second european conference on e-learning, 2003, pp. 369-379.

[22] K. Kurbel, "Virtuality on the Students' and on the Teachers' sides: A Multimedia and Internet based International Master Program; ICEF Berlin GmbH," in Proceedings on the 7th International Conference on Technology Supported Learning and Training–Online Educa, pp. 133-136.

[23] A. Klašnja-Milićević, B. Vesin, M. Ivanović, Z. Budimac, and L. C. Jain, "Adaptation in E-Learning Environments," in E-Learning Systems, ed: Springer, 2017, pp. 37-42.

[24] R. C. Clark and R. E. Mayer, E-learning and the science of instruction: Proven guidelines for consumers and designers of multimedia learning: John Wiley & Sons, 2016.

[25] M. Bosamia and A. Patel, "AN OVERVIEW OF CLOUD COMPUTING FOR E-LEARNING WITH ITS KEY BENEFITS," International Journal of Information Sciences and Techniques (IJIST) Vol, vol. 6, 2016.

[26] C. Fallon and S. Brown, E-learning standards: a guide to purchasing, developing, and deploying standards-conformant e-learning: CRC Press, 2016.

[27] Y. Sabbah, "E-learning at al-quds open university current situation: A case study," International Journal of Excellence in e-Learning, vol. 3, pp

[28] [28] B. M. G. THABET, G. H. HAMED, and S. Z. FARHANEH, "sLOOC Courses as OER for Community Development," presented at the 1st International Conference On: smart learning for community development, Palestine, 2017.