AI Based Learning Environment - Issues and Solutions

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Abstract-*The field of artificial intelligence in education has becoming the most challenging area in the last several decades. Using AI concept and techniques, new forms of intelligent software can be created. That allows the computer to act as an intelligent learner or tutor. In this paper several issues and their solutions are proposed for an AI based learning environment. The issues that are discussed in this paper are pedagogical issues, technical issues and security issues while creating a A.I. based e learning platform. The solutions for these issues are also proposed in this paper.*

Keywords-AI, Cognitive modelling, Computer supported collaborative learning, E-learning, Pedagogic, Virtual learning environments.

I. INTRODUCTION

Education is supposed to be the base of any society, future of any country is depends on their education system. In traditional teaching –learning system, there is one teacher and lot of students, where the teacher teaches all the students in one single manner, this becomes very monotonic and boring. Because each student have different grasping power, different IQ level and different method of learning, and so many students don't find that interesting, lose their hopes in study and hence they remain behind in education system. Here arises the need of the teaching process effective and enhancing the learning skills of student using different technologies and methods.

With the growth and popularity of internet web based system are becoming more and more effective. It includes the disciplines; cognitive and social psychology, education computer science, empirical psychology, software and knowledge engineering [1] [2]. The goal of the field is to deliver computer-based systems (or knowledge-based software) which can be used in real teaching, learning and training situations. By using Artificial Intelligent concepts new forms of intelligent *E-learning*/tutoring software can be created that allow the computer to act as an intelligent learner. Such AI based intelligent system can adjust its tutorial to the student's -Knowledge, experience, strengths, and weaknesses. It may even be able to carry on a natural language dialogue.

What does E-Learning mean exactly?

It is still a topic of research and discussions are still going on. The concept like E-Learning is relatively a new term and has been evolving over number of previous years [6]. A major challenge in the field of E-learning is to make teaching material reusable [3]. A solution that became widely acknowledged is the learning object approach, and revolves about a set of principles that facilitate the reuse and the distribution of knowledge intended for teaching. Moreover, to build virtual learning environments that do not require the attendance of human teachers and that is able to provide highly tailored instruction, it is necessary to model the cognitive processes of the learner by means of cognitive models. However, these models often avoid the issues of knowledge engineering specially, knowledge reuse and knowledge distribution. In this paper we proposes techniques to merge the principles of the cognitive modelling theories [3] and those of the learning objects approach, in order to benefit from the advantages of each method. The subset of distance education that makes use of computer technologies is E-learning. The latter currently shows a strong growth, as a consequence of the current educational context, the opportunity to use high quality multimedia content, and the possible interactions between learners and trainers over the Internet. According to the American marketing company IDC, the size of the E-learning world market which represented US$ 150 billion at the beginning of 2016 and is predicted to grow over 5% CAGR from 2017 to 2024.

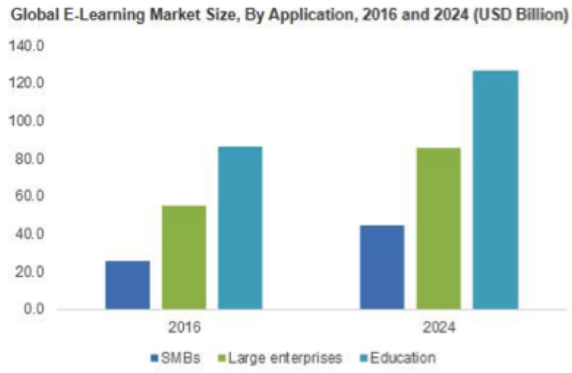

Fig 1: Market size for E learning

Artificial intelligence affects growth and productivity in many sectors (for example, transportation, communication, commerce, and finance). However, one painful exception is

education; specifically, very few AI-based learning systems are consistently used in classrooms or homes. Yet the potential exists for AI to have a large impact on education: As described by the articles on education in this and the previous AI Magazine issue, AI-based instructional software now routinely tailors learning to individual needs, connects learners together, provides access to digital materials, supports decentralized learning, and engages students in meaningful ways. As a society we have great expectations for the educational establishment (for example, train employees, support scientific and artistic development, transmit culture, and so on) and yet, no matter how much is achieved, society continues to expect even more from education. The today's educational system of fixed classroom lectures, and printed textbooks is clearly not capable of serving a digital society. Classrooms and textbooks are especially inappropriate for people who use mobile and digital technology every day. For example, digital natives learn and work at twitch speed, through parallel processing, and connected to others (Beavis 2010). For digital natives, information is instantly available, change is constant, distance and time do not matter, and multimedia is Omnipresent. No wonder schools and classrooms are boring!

Research into the learning sciences and neuroscience provides essential insights into the intricacies of learning and the processes underlying learning, offering clues to further refine individual instruction. For example, students learn more when they work in teams on motivating and challenging group projects; they retain more when they immediately apply what they learn; and they learn more when they receive help from human tutors who respond quickly, in ways that reflect deep understanding of the learner's background, strengths, and weaknesses. Applying such new insights about human learning in digital learning environments requires far deeper knowledge about human cognition, including dramatically more effective constructivist and active instructional strategies. AI techniques are essential for developing representations and reasoning about these new cognitive insights, for providing a richer appreciation of how people learn, and for measuring collaborative activity. AI will be a game changer in education. In fact, education and AI can be seen as two sides of the same coin: education helps students learn and extend the accumulated knowledge of a society and AI provides techniques to better understand the mechanisms underlying thought, knowledge, and intelligent behaviour.

II. PEDAGOGICAL ISSUES

A. Isolation

Isolation refers to the learner's lonely experience during an e-learning course without any contact whatsoever with other learners or educators. Bousaaid, Ayaou, Afdel, &Estraillier [5] investigate this phenomenon and conclude that the simple act of participating within a network of like-interested persons within a social network assists e-learners and renders the entire process more effective. They argue that latest Web 2.0 technologies actually promote even more communal practices whereby learners are able to collaborate, share and communicate freely with others. Similarly Davies & Merchant [8] highlight the ability of Web 2.0 to enrich and transform the educational experience. Web 2.0 [9] is considered to be a phase, or the second generation, of web technologies that promote "user-generated content coupled with mechanisms that enable and enhance user interaction". The authors identify four characteristic features to capture the essence of Web 2.0, namely, presence, modification, user-generated content, and social participation. These features, apart from reducing the isolation problem, go further and promote the individuality of the users while establishing a personalisation element. The learning theory associated with this issue is connectivism which, together with other elements, will form part of the model being proposed in this paper.

B Lack of motivation

The second e-learning issue being addressed, learner motivation, could be affected by a number of issues but thelack of enthusiasm usually results from either learners wholack determination, or simply are not interested in the subjectmatter. Attempting to engage learners with the educationalcontent by rendering it relevant to them and relate it as closelyas possible to their own interests has been investigated by Tang & McCalla [10] where they highlight the importance of learner feedback in order to offer in return course materials that motivate further individual students based on their personal profile. Motivation is an important issue in every learning situation but in regards to e-learning the need for learners to be self-determined is even greater. The proposed model couples the self-determination learning theory with the corresponding learner profiling approach to address this particular issue.

C. Impersonal

The third e-learning problem being addressed is related to the impersonal sensation learners feel when interacting with an e-learning environment. Lack of human interaction but also the insensitive nature of hyperspace magnifies this issue. The concern is addressed through the dynamic and adaptive nature of Web 2.0 features mentioned earlier. The adaptive learning

theory is associated to this particular issue in tandem with personalisation techniques as part of the solution that this paper attempts to address, propose a solution, and investigate the outcome in the following sections.

D Mentors for Every Learner

Creating mentors for every learner requires research into how people learn. Research in the learning sciences (LS) has taught us a great deal about processes involved in learning; learning sciences addresses both how people learn and how to promote learning in real-world situations — how to capture learners' attention and keep them engaged, how to promote learning of difficult concepts, how to take advantage of the social and physical aspects of the classroom to promote reflection, the role of the teacher in promoting learning, and more. This focuses on applying these findings to the design and building of systems that can interact with learners in natural ways and act as mentors to individuals and collaborative groups when a teacher is not available. To mentor effectively and support individuals or groups while learning, an intelligent system needs to model the changes that occur in learners. Estimates of a learner's competence or emotional state, stored in user models, represent what learners know, feel, and can do. When and how was knowledge learned? What pedagogy worked best for this individual or group? Machine-learning and data mining methods are used to explore unique types of educational data and to better understand students and the settings in which they learn (see Conati and Kardan [2013], Koedinger et al. [2013]). Simulations and representations should dynamically explain themselves to learners and switch modalities as appropriate; for example, provide videos or appropriate animations. Learning should occur in authentic contexts and motivate information- seeking behaviours. We envision that the current paper textbooks will evolve into digital workbooks that are aware of such contexts and provide students with immersive learning experiences, breaking away from their current linear flow, to be adaptive to student's current state of learning, to embed simulation and virtual laboratories, and to more broadly engage in dialogues with students.

E Interaction Data to Support

Learning is about exploring and leveraging the unique types of data available from educational settings and the use of this data to better understand students, groups, and the settings in which they learn (Baker, Corbett, and Aleven 2008; Baker, Corbett, and Wagner 2006). Two distinct research communities have evolved to examine this data: learner analytics (LA) and educational data mining (EDM). The two areas have significant overlap both in their objectives and the methods and techniques used. Common goals include support individual learners to reflect on their achievements; predict students' requirements for extra support and attention; help teachers plan supporting interventions; and improve current courses or curriculum. One difference between the two communities is that the EDM community, originating from the intelligent tutoring systems community, often works on very small-scale cognition, for example, student mastery of specific topics, time spent on problems. Moreover EDM methods are drawn from a variety of disciplines which includes data mining, machine learning, information visualization, and computational modelling. Learning analytics researchers are more focused on enterprise learning systems (for example, learning content management systems) and focus on issues such as student retention and test results; they often combine institutional data, statistical analysis, and predictive modelling to identify which learners need help and how instructors might change their pedagogical approach.

III. TECHNOLOGICAL AND SECURITY ISSUES

A. User Authorization and Authentication

The elementary feature of E-Learning system is the reliable identification of the user because it is the basis for Access control to the E-Learning system. The degree of authorization can be classified based on two basic categories viz. users with or without proper authorization. The Authorization is usually is granted only to registered students and even their access is generally restricted to a certain subset of the E-Learning material based on the billing if E-Learning is offered on billing basis and on the level of learning of the registered student which will allow him to either to move to the next level or have a revision of the previous session [7]. It is not possible to correctly identify a student if he is interacting from a distance location. Therefore physical security may be required to handle such issues.

B. Dynamic Nature

The other challenge is the dynamic nature of these systems where there are dynamic sessions where any process may join or leave the group sessions at any time. Security is also concern with each particular member process, a strict session has to be maintained and the credentials are to be verified to control both at the session level and at the participant site.

C. Protection against Manipulation

One of the issues of E-Learning is manipulation from the side of the students the system must be secured against manipulation. There are many possible solutions where any manipulations can be protected by using the techniques of encryption, digital signatures, firewalls, etc.[7] These mechanisms are needed to prevent manipulations from a third side but one needs additional mechanisms against manipulation from the side of the legitimate users.

D. Confidentiality

Due to the fact that learning material by its nature must be distributed to the outside, industrial espionage and data theft are not major problems in E-Learning. The user should obtain access only to authorized contents and those persons who are not the legitimate users must not be able to gain access to the system.

E. Integrity

Integrity is that only authorized users are allowed to modify the contents which include creating, changing, appending and deleting data and metadata and the attacks on integrity are generally the attempts made to actively modify or destroy information in the E-Learning site without proper authorization.

IV. RESEARCH ISSUES FOR E-LEARNING

Socio-cultural factors including pedagogical, technical and organizational concerns with the E-learning research. These factors influence the research agenda in e-learning system. Understanding these broader social and cultural issues is of significant importance to the research communities involved in e-learning and will have a significant role in informing future practices. In consulting the INDIA research community, a number of research issues emerged:

A. Interdisciplinary and the notion of multiple voice

Is a defining characteristic of the area, how do different research perspectives influence the overall area? How do problems in the practice of different disciplines differ in the adoption and use of learning technologies?

B. Access and inclusion

It includes issues around the widening participation agenda. What are the barriers to inclusion and what are the issues surrounding the extent of the digital divide?

C. Change and its relationship to learning technologies

How does change impact upon motivational issues? What are the drivers and rationales for change? What are appropriate strategies for managing changes and mechanisms for their implementation?

D. Convergence and interoperability

In terms of exploration of different forms of convergence (organizational, technological, pedagogical, sectorial, institutional, etc.). How well do they understand issues of globalization and scalability standards to support interoperability? These are complex relationships. A current focus is also on standardization across the pedagogical, technical, organizational and human aspects versus critique of convergence.

E. Interactivity and social interaction

How does the interactivity of different tools relate to, or impact upon, the nature of the medium? How is interactivity expressed at different level? How have organizational boundaries and functional groupings blurred as a consequence of new technologies? What potential do the new technologies have to enhance communication and collaboration and also creating new communities and networks?

V.PEDAGOGICAL SOLUTIONS

A. Computer Supported Collaborative Learning (CSCL)

The CSCL are defined as instructional methods that look for promoting learning through a collaborative effort in a particular area of learning, where students interact with others to solve a problem. Ellis [3] identifies different applications, decomposing the collaborative systems across a temporary space matrix. Some are presented below. Face to Face Interaction (same place and same time). A shared screen for explanations, conversation, environments and brainstorming, centralized Asynchronous Interaction (same place and different time). An example of this application is the discussion forum provided on a computer where people contribute with their comments. • Distributed Synchronous Interaction (different place and same time).

B. Software Agents

A key area in current software engineering activity is the utilization of what are called agents in the interactions between software, the user and communication devices. Introduction to intelligent agents in the educational

environment and the concept of the pedagogical agent is not new. The use of pedagogical agent in this paper reflects a wider perspective on the possible use of agents. This paper is primarily concerned with defining pedagogical agents as intelligent interactive software tools often including what is called a guide. Working from a different perspective, we are interested in the role of the agent in a monitoring and evaluation function that need not include any interaction with the user. We see our form of pedagogical agent being concerned with establishing user behaviour and response patterns that help evaluate [4] • The functionality of the educational software • The way the learning materials contained in the software aid learning • The extent to which the use of the software in the learning environment has met the underlying educational objectives An intended future development from this starting point will be the development of intelligent, interactive agents that are programmed to use the information extracted during the monitoring phase. The issues here also apply to many Web-based learning tools where the learner has a much wider scope for action that the learning task might have required. In fact, Web-based tools may have been generated with the intention of encouraging exploration beyond the basic task.

C. Intelligent Tutoring System (ITS)

The approach known as ITS has been pursued by researchers in education, psychology, and artificial intelligence. The goal of ITS is to provide the benefits of one-to-one instruction. It enables learners to practice their skills by carrying out tasks within highly interactive learning environments. Normally, computer based systems such as CAL (Computer Aided Learning) or CBT (Computer Based Training) use traditional instructional methods by providing instruction to learners without concerning themselves with a model of the learner's knowledge. Thus, these instructions sometimes cannot assist learners individually. By contrast an ITS assesses each learner's actions within these interactive environments and develops a model of their knowledge, skills, and expertise. Based on the learner model, it can tailor instructional strategies, in terms of both the content and style, and provides relevant explanations, hints, examples, demonstrations, and practice problems to individual learner .Figure 2 shows the simple model for intelligent tutoring system. It consist expert model, instructional model, learner model and interface model.

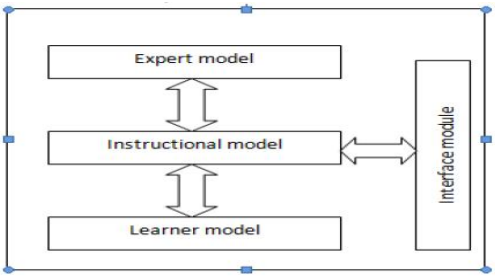

Fig 2: Model of ITS

D. Multi-Agent System- MAS Applied To Learning Environments

A MAS [10] is an organized society composed by software agents that interact with each other, either to assist in resolving a series of problems or in achieving a series of individual or collective goals. These agents can be homogeneous or heterogeneous and may have common goals or not, but always involve some degree of communication between them. The principles of the MAS have shown an appropriate potential in developing education systems, where the elements can be decomposed into collections of pedagogical independent agents exchanging information and cooperating with each other in achieving the learning goals.

VI. TECHNOLOGICAL SOLUTIONS

A. Association Rules

Association rules [12] are simple directives that imply specific associations or correlated relationships between groups of items within a specific domain. Such rules are generally employed to discover patterns from data collected. Given a set of facts about the user's academic achievements, and an associated list of tasks and topics, the rules formalise the connotations between them. For the sake of simplicity, a classic example involves shopping trends of consumers. It is common knowledge that whoever purchases wine and cheese, the chances of purchasing grapes as well is about 75%. Such a rule, with an associated numeric value, can work out what future consumers will likely to go for after purchasing cheese and grapes. Association rules have been applied to different domains like large databases [11], e-Commerce [12], and education [13]. If such rules were to be employed, then some previous knowledge of students' trends and interest will be required to create the required association rules.

B. Case-Based Reasoning

Another artificially intelligent technique used to generate a user profile is called case-based reasoning that makes use of previous cases that are similar to the current

problem at hand and applies or adopts the solution to the situation. So, given a student who has a problem with understanding a particular academic topic, the case-based reasoner retrieves relevant cases that match such a request and adapts solutions that were effective to solve the similar problem. The difficult part for the classification task arises when the system is required to identify a target class for a case that has no classification. In such instances the solution to this dilemma is simply fitting the class that is most similar. Case-based reasoning has been employed as a learner profile generator in various customisation scenarios like web information searching topical filtering of data and document clustering

C. Bayesian Networks

The final computer science technique that is commonly used to create a user profile automatically is through the use of Bayesian networks. A network is simply a set of points interconnected to each other with links or lines. This system makes use of lines to link items of interest that are related to each other. This means that there is no relationship between disconnected topics of interest to a student. On the other hand a subject that is connected to another topical matter, that in turn is connected to a third theme, automatically infers a transitional association, thereby proposing the third item as a potential topic of interest to the student. Make extensive use of such networks to capture student's behaviour within an e-learning system and model their learning styles. Other uses include web browsing personalisation intelligent help systems, and expert systems .What emerges from the above brief descriptions is that any of these basic techniques can be employed to generate a student profile and personalise the content that is presented to the same student. To point out that all learner profilers perform as well as the quality of the input information that they employ to generate the profile. It is for this reason that this process depends entirely on the learner and will only be as successful as much as the learner puts in effort and energy. It is also for this reason that the technological paradigm is founded upon the self-determination learning theory that places the onus on the learner. This theory relies entirely on supporting learners' fundamental tendency to conduct themselves in an optimal way in order to maximise the benefits they can extract.

VII. SECURITY SOLUTIONS

A. SMS (Short Message Service) Information SecurityMechanism

Most of the students in Saudi Arabia have a mobile phoneas a means of communication, this can be an added advantage to the universities offering E-Learning system, where a student is first authenticated with a user id and password, the E-Learning system generates a special password for the session and sends SMS message to the registered mobile phone in the E-Learning system.

B. Token Based Information Security Mechanisms

A security token called sometimes as hardware token, hard token, authentication token, USB token, cryptographic token, or key fob may be a physical device that an authorized user of computer services is given to ease authentication [11]. Saudi universities can provide students with Security tokens to prove students identity electronically. The token can be used in addition to or in place of a password to prove that the student is who they claim to be. The token acts like an electronic key to access E-Learning System.

C. Access Control List (ACL) Mechanism

Access control list provides the access to the resources found in the system or the web server. Any access control will have two components for successful functioning of the system [7]. In an E-Learning environment the student has to have access to the resources they are intended for there are configuration tools that allows to grants which user have access to which resources and a means to authenticate the users to identify them properly, which can be controlled by using the one of the three most popular methods for authenticating and controlling access to the users in a web scenario.

VIII. CONCLUSION

The main objective of this was to introduce the Artificial intelligence in teaching learning system. AI can be effectively used to make the learning personalized. Model of e-learning based on the integration of Intelligent Tutoring Systems, Multi-Agent Systems and Collaborative Learning Environments will help the e-learning platforms to deploy AI in their learning platforms. Model for creating reusable units of knowledge that incorporate semantic knowledge, procedural knowledge and didactic knowledge Focused on contributions that AI can make to address long-term educational goals and discussed need of securing E-Learning systems and why it is necessary to provide the users a secure system and also basic security requirements of an E-Learning system.

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