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# Artificial Intelligence in E learning Using Pedagogical Software Agents

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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. Therefore the aim of this paper is to present an environment of virtual teaching or learning trough an integration model based on pedagogical software agents such as Intelligent Tutoring systems (ITS) and computer supported collaborative learning (CSCL).***

***Keywords— Artificial intelligence, Pedagogical software agents, intelligent tutoring system, Computer supported collaborative learning.***

## I. INTRODUCTION

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][4].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. Using AI concepts and techniques new forms of intelligent e-learning/tutoring software can be created that allow the computer to act as an intelligent learner/ tutor. 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.

Intelligent e-Learning systems (IeLSs) are knowledge-based systems that imitate the human mind. The main characteristics of these systems are the ability of inference, reasoning, perception, learning, and knowledge-based systems [3][2]. AI is the backbone of the IeLSs.AI gives IeLS added computing capability, allowing them to exhibit more intelligent behavior. To a limited degree, AI permits IeLS to accept knowledge from human input, and then use that knowledge through simulated thought and reasoning processes to solve problems.

Intelligent Tutoring Systems (ITS) allow students to facilitate their learning process, automatically planning a series of activities adapted to their characteristics. Thus, we can say that ITS are different from the traditional methods because while studying the apprentice not only listens and takes note passively, but carry out some significant learning activities in an autonomous and personalized way [6][7]. The collaborative learning environments are instructional methods that aim to strengthen the student's knowledge, through the collaborative effort, providing an environment that fuels and enriches the process, allowing students to interact to solve a problem. Our hypothesis is that a system that integrates the benefits of ITS with the capabilities of Computer Supported Collaborative Learning (CSCL), may provide an active learning in a clear and attractive way for the students.

## II. THEORETICAL FRAMEWORK OF PEDAGOGICAL SOFTWARE AGENTS

The growth of Internet has created new ways for education systems. Learners and teachers realize their pedagogic activities with less effort, time and money. Agent Based Intelligent System (ABIS) have proved their worth in multiple ways and in multiple domains in Education. An ABIS is a system that provides direct customized instruction or feedback to students without the intervention of human beings [8][9]. With the explosion of content on the World Wide Web (WWW), the scope of application of Data and Web Mining to E- Learning applications has increased tremendously. In this work, we identify a set of applications which go one step ahead from ABIS and use the WWW to aid the learning process of the "learning object content". Each application has a high level of coupling with the knowledge representation model, which models the resources stored in the Digital Library [8]. Pedagogical software agents represent a new paradigm for teaching and learning based on research in the areas of animated interface agents and interactive learning environments (Johnson et al., 2000). Furthermore, animated pedagogical agents have the potential to broaden the bandwidth of social communication between computers and students and increase student engagement and motivation (Johnson et al., 2000).

Pedagogical agents are autonomous agents that support human learning, by interacting with students in the context of interactive learning environments. They extend and improve upon previous work on intelligent tutoring systems in a number of ways. They adapt their behaviour to the dynamic state of the learning environment, taking advantage of learning opportunities as they arise. They can support collaborative learning as well as individualized learning, because multiple students and agents can interact in a shared environment. Given a suitably rich user interface, pedagogical

 

agents are capable of a wide spectrum of instructionally effective interactions with students, including multimodal dialog. Animated pedagogical agents can promote student motivation and engagement, and engender affective as well as cognitive responses.

(Johnson 1998:13)

The intelligent tutoring system is such a broad term, it encompassing any computer program that contains some intelligence and can be used in learning. ITS is an outgrowth of the earlier computer-aided instruction or CAI model, which usually refers to a frame-based system with hard-coded links, i.e. hypertext with an instructional purpose.

The traditional ITS model contains four components: the domain model, the student model, the teaching model, and a learning environment or user interface. ITS projects can vary tremendously according to the relative level of intelligence of the components ITS can also be classified by their underlying algorithm. One well-known category is the model-tracing tutor, which tracks students' progress and keeps them within a specified tolerance of an acceptable solution path.

A theme underlying much of ITS research is domain independence, i.e. the degree to which knowledge encoded in the teaching model can be reused in different domains. Although to the external observer, domain independence seems like an essential characteristic of intelligence, many experts believe that some of the essential pedagogical knowledge in every domain is fundamentally domain-dependent. For example, there are analogies used in teaching physics, and even in teaching specific topics in physics, that have no equivalents in other domains.

## III. BACKGROUND

### *A. 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 [8]. 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 [1] [8]:

- 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.

### *B. 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[2][5][9]. 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 [5]. Figure 1 shows the simple model for intelligent tutoring system. It consist expert model, instructional model, learner model and interface model.

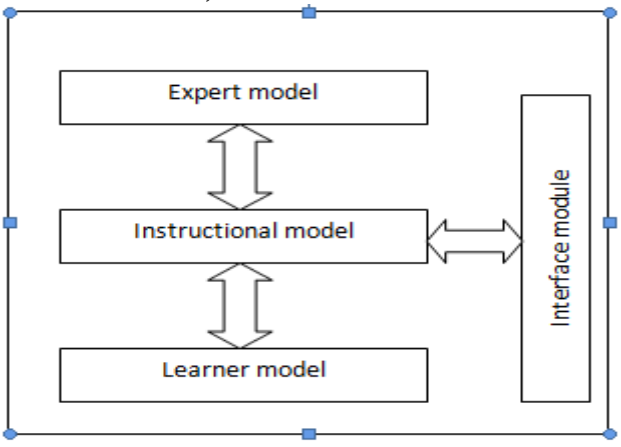


Fig: 1.Model of Intelligent Tutoring System

 

*An Expert Model* Expert Model is a computer representation of a domain expert's subject matter knowledge (declarative knowledge) and problem-solving ability (procedural knowledge). This knowledge enables the ITS to compare the learner's actions and selections with those of an expert in order to evaluate what he or she does and does not know[3][5].

*A Learner Model* Learner Model is a level of learner's knowledge while he/she interacts with the tutoring system. The model evaluates each learner's performance from his/her behavior during interacting with the tutoring system in order to determine his or her knowledge, perceptual abilities, and reasoning skills. The model will generate evidence and uses inference to provide a number of relevant instructions to individual learner [5].

*An Interface Model* Interface Model is important as a communication medium and learning environment that can support learner in a task. It can also act as an external representation of the expert model and instructional model. These kinds of tutoring systems can provide the learner a wide selection of practice database case studies alongside individualized feedback for solving each case study. Moreover, it is very convenient for the learners, who need to practice and learn at their own pace [5].

An Instructional Model Instructional Model contains knowledge for making decisions about instructional tactics. It relies on the diagnostic processes of the learner model for making decisions about what, when and how to present information to a leaner. For example, if a learner has been evaluated as a beginner in a particular procedure, this model will show some step-by-step demonstrations of the procedure before asking the user to perform the procedure on his or her own. When a learner gains expertise, this model might decide to present increasingly complex scenarios. Furthermore, this model may also choose topics, simulations, and examples that are relevant to a level of learner's knowledge [3].

### *C. Agent Based Intelligent Tutoring System (ABITS)*

Agent based intelligent tutoring system (ABITS) providing a personal training assistant for each learner is beyond the training budgets of most organizations. However, a virtual training assistant that captures the subject matter and teaching expertise of experienced trainers provides a captivating new option. The concept, known as ABITS or intelligent computer-aided instruction (ICAI), has been pursued for more than three decades by researchers in education, psychology, and artificial intelligence. Today, prototype and operational ABITS systems provide practice-based instruction to support corporate training, schools and college education, and military training [5]. The goal of ABITS is to provide the benefits of one-on-one instruction automatically and cost effectively. Like training simulations, ABITS enables participants to practice their skills by carrying out tasks within highly interactive learning environments. However, ABIS goes beyond training simulations by answering user questions and providing individualized guidance. Unlike other computer-based training technologies, these systems assess each learner's actions within these interactive environments and develop a model of their knowledge, skills, and expertise. Based on the learner model, ABITS tailor instructional strategies, in terms of both the content and style, and provide explanations, hints, examples, demonstrations, and practice problems as needed.

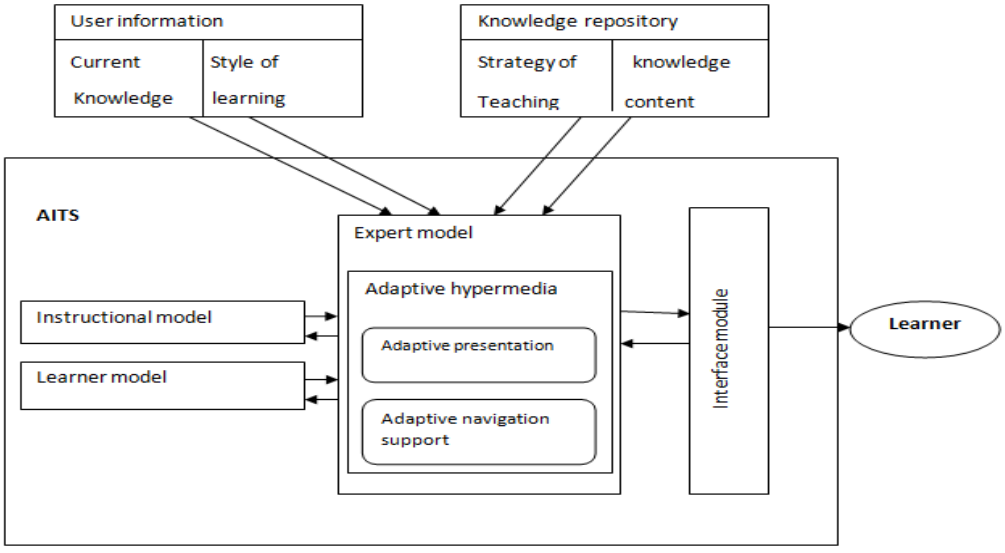


Fig: 2. Adaptive Intelligent Tutoring System for E Learning System

Figure 2 presents AITS for E-Learning Systems, the situation is essentially different in the case of learning produced using Adaptive Hypermedia (AH) and ITS that technologies are able to dynamically select the most relevant learning material from their knowledge bases and present it at the right time and in the right way for every individual learner, thus making the best use of every fragment of educational material. Both are normally used for computer-based instruction. However, AH is better suited for the instruction of concepts whereas ITS generally assists in the use of these concepts to solve problems. Therefore, a general instruction system requires both of these instructional approaches in order to provide a full learning with adaptation based on Learners' behaviour via Internet [3].

 

### *D. 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 [10]. Ellis [11] identifies different applications, decomposing the collaborative systems across a temporary space matrix. Some are presented bellow.

- 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).

### *E. Multi-Agent System- MAS Applied To Learning Environments*

A MAS [14] 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 [13]. 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.

## IV. CONCLUSIONS

This paper proposes a model of e-learning based on the integration of Intelligent Tutoring Systems, Multi-Agent Systems and Collaborative Learning Environments, making the necessary modifications to the models to withstand such integration. The proposed environment presents adaptability in the following issues: the instructional planning, the presentation of contents, the planning of assessments, the conformation of working groups, and the choice of strategies for collaborative work. Even if a detailed explanation of each processes are not presented on this paper, the general functioning is described. Such environment is supported by a Multi-Agent approach, which was helpful to modularize and specialize the functionally of the different issues of the environment. It is noteworthy that a distributed architecture has been raised looking for greater versatility, parallelism, and better system performance. As future work we aimed at developing a resources manager module of the ITS (especially for the handling and management of knowledge of the domain model), to create courses in a quick and guided manner. This module should include all the elements individually required by each of the three approaches ITS, CSCL, and MAS, and the relationships between each element. Finally, we can improve the system CIA including standards to enhance the planning and the integration with other platforms, because only the LOM standard is currently covered.

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