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Using Intelligent Tutoring Systems in Instruction and Education

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Abstract. Nowadays, beside computer has come into our life, learning, independent from time and place, is implemented in an effective structure. Since many studies are consummated education is implemented in a structure which takes into account. Benefits of the qualities include being more effective, qualified and independent from time and place. In order to develop the software's that present students effective instruction methods and provide education with being adapted to students, studies are carried out.
Intelligent Tutoring Systems (ITSs) are tutoring systems which form with using artificial intelligence techniques in computer programs to facilitate instruction. These systems are based on cognitive learning theory which is a learning theory interested in how information organizes in human's memory. ITSs are intelligent programs which know what, how and whom they will teach so computers play an important part in education and instruction aims are performed and suggested in this work. In this paper we describe ITSs in educational application and demonstrate used modules in ITSs. Otherwise, these have been compared with computer-aided learning systems.
The results indicate that these systems formed with artificial intelligence techniques omit this incompetence with vast rate and countenance students and teachers to learning in a better manner.

Keywords: Artificial Intelligence, Intelligent Tutoring System, Computer-Assisted Tutoring, Instruction, Education.

1. Introduction

Nowadays, with the 21st century's, computers play an important part in that education-instruction aims are implemented. Beside computer has come into our life, learning, independent from time and place, is performed in an effective structure. Also, software that present students effective instruction methods and provide education with being adapted to students begins to be developed. The most important software category which is developed with this aim is Intelligent Tutoring System (ITS) which is formed by using computer Technologies and Artificial Intelligence. ITSs are tutoring systems which form with using artificial intelligence techniques in computer programs to facilitate instruction [1, 2]. These systems are based on cognitive learning theory which is a learning theory interested in how information organizes in human's memory [3, 4]. ITSs are intelligent programs which know what, how and whom they will teach [5, 6, 7, and 8].

In ITSs, the specifically intended is that instruction is specialized according to the student's level and a suitable personal excursion is given to the student [9, 10]. Students have more control in Intelligent Tutoring models. Studding for forming computer systems which lead to students while learning is being implemented and which students are more active in instruction have been carried out. By this way, since teachers care students when they need, the time that teachers give each student will increase. The most basic problem to form, ITS how the system will be organized in accordance with the student's level.

2. Intelligent Tutoring Systems

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ITSs are education systems which aim at high qualified and operational education, by this aim, try to provide an individual atmosphere for a student as if he is in one to one interaction with a professional educator, present necessary resources in time, which are adapted according to individuals and in which the applications that prevent the student from being lost are developed in a data base [3, 5, 6, 15]. In other words, ITSs are computer systems which know what, how, to whom it will teach and are designed by benefiting from within techniques that take place in common formation of artificial intelligence [8, 16]. The techniques such as artificial intelligence decision networks have been applied to intelligent tutoring systems. Ready algorithms or devises exist so, these techniques can be done. One or a few of these algorithms and devises can be used when the application is designed. Although it is hard to give a certain answer to the question why ITSs are better than other instruction forms, many explanation provides active participation in instruction and students' guidance service for a good education [3, 9, 11, 12].

This means that enough feedbacks to solve confusion should be provided for students and they should do a lot of work as much as possible. Moreover, an forceful ITS presents students less instructive information and provides more interaction. ITSs offer a chance that students are able to learn suitable subjects for their level independently from time and wherever they want [12, 13, and 14].

Also, ITS designed for solving some problems of Internet-based education. Some of these problems are [3, 5, 6, 13, and 17]:

- It is quite hard to find the suitable pages for students' level in available data base if necessary and concentrate on the subject.
- The pages are presented in a stable row. Each student doesn't have a suitable and impressive presentation.

If we take these problems into consideration, ITSs are aimed at indicating a learning atmosphere which is suitable for the student's knowledge level. Thus, a fast and permanent learning will be achieved. According to the study which has been carried out in Carnages-Mellon University, ITS have been compared to computer-aided learning systems and it has been determined that ITSs have increased their learning quality as 43 percent and decreased their learning period as 30 percent [2].

ITS should be flexible in terms of both student and system. The more flexible the system is, the more it approaches the effectiveness of face to face education and in order to provide this flexibility, the system is implemented in various modules [11, 18]. ITSs consist of four different modules: the student module, the expert module, the tutor module and the user interface module [2, 4, 13, 15, and 17].

2.1. Student Module

The student module uses a student model containing descriptions of student knowledge or behaviors, including his misconceptions and knowledge gaps [1, 10]. An apprentice technician might, for instance, believe a thermostat signals too high temperatures to a misconception or might not know about thermostats that gauge the outdoor temperature as well as.

In other words, the cause of collecting information about student is to determine the education level of student and the most suitable learning method for this. Since various information such as voice, gesture, appearance, etc might be required in order to obtain the dates about student performance and knowledge level, it may not be possible for every time to identify a complete student module [11, 15, and 18]. The collected information is stored in data base when it extracts from the system and if necessary; it is taken from data base and used. ITSs serve two basic aims [5, 6, 11, 14, and 18]: To form a learning program adaptable according to the student and to be a guide to solve student's problem.

2.2. Expert Module

The expert module references an expert or domain model consist of a description of the knowledge or behaviors that represent expertise in the subject-matter domain the ITS is teaching, often an expert system or cognitive model [13, 15]. An example would be the kind of diagnostic and subsequent corrective actions an expert technician takes when confronted with a malfunctioning thermostat. It is the module in which main information and tutorial information that are going to be taught take place. We can say that the better expert module is designed and the more proper it is the more proper.

Expert module should be parallel with the knowledge's which are stored in student module [5, 10, 17]. It is to say, when a student module is identified, the data base suitable for this module should be able to be presented to the user easily. This organization is a bit complicated but it is necessary for the system to process in an expected level. There are two main functions performed by expert module, these are [5, 12, 14, 15]: Developing question, answer and explanations. Thus behaving like a resource. According to Cooley and Lohnes [3], an evaluation is a process which related dates are collected and transformed into knowledge in order to decide.

The evaluation in ITS has an important place as it does in education programs [3, 4, 19]. The evaluation is constantly carried out due to the fact. It is interaction with student intensely implements in ITS. The evaluation of this system is implemented in two ways as formative and summative: Screens has defined the difference between formative and summative evaluation that formative evaluation implements on being designed and at the first stages of a reformed project and it concentrates on answering a designer's needs. On the other hand, summative evaluations evaluate completed systems and make figural judgments about these systems. Formative evaluation is regarded as a computer-programming methodology which shapes the development in the cycle of designing, executive and formative evaluation Also, Formative evaluation is used to obtain the detailed information which is useful for changing and developing a function of ITS. Contrasts to Formative evaluation, Summative Evaluation make formative evaluations about some techniques and methods which are used in a system.

2.3. Tutor Module

A mismatch between a student's behaviour or knowledge and the expert's presumed behaviours or knowledge is signalled to the tutor module, which subsequently takes corrective action, such as providing feedback or remedial instruction. To be able to do this, it needs information about what a human tutor in such situations would do the tutor model.

This module contains the information which includes tutoring strategies and tactics which are stored in student module and which will be used to student's qualities. Tutor module provides necessary information so that tutoring aims can be achieved. This module must have control over choice and sequencing of subject materials which will be showed students [2, 13, and 14]. Besides, it will answer students' questions properly and will present the needed help when they solve a problem or perform their skills. It must have a mechanism which will be able to determine what kind of help to be presented.

Tutor module in ITS uses two different presentation methods [17]. These are Secretive and Executive models. In Secretive model, the system gives a set of questions to student in order to reduce misunderstandings to minimum, on the other hand, in executive method; the information which wants to be obtained is attained with platforms such as game [18]. By this way and the information about skills of students and solving problem is obtained.

2.4. User Interface Module

The user interface module provides the means for the student to interact with the ITS, usually through a graphical user interface and sometimes through a rich simulation of the task domain the student is learning [5, 10, 13, and 18].

Interface design is the area in which classical multimedia authorship tools of ITS are used the most. Because it takes too much time to form an interface. The interfaces, graphics and ready texts which are generally used in instructional software and computer systems contain the areas for information input by means of keyboard and menus. User Interface Module requires three types of information to implement the dialogues. These are [2,12,14] information about the model which form the required explanations to understand the speaker during a dialogue and the required activities to create verbal expressions, the area information which is necessary for the content of communication and the information which is necessary for the aim of communication.

The user interface module is the communicating component of the ITSs which controls interaction between the student and the system. In both directions, it translates between the system's internal representation and an interface language that is understandable to the student [6]. Because the user interface

can make or break the ITSs, no matter how 'intelligent' the internal system is, it has become customary to identify it as a distinct component of ITS own [8]. In fact, it would be a mistake to consider it a secondary component of the ITS for two main reasons.

An ITS is only as effective as the various models it relies on to adequately model expert, student and tutor knowledge and behaviours. Thus, building an ITS needs careful preparation in terms of describing the knowledge and possible behaviours of experts, students and tutors [15]. This description needs to be done in a formal language in order that the ITS may process the information and draw inferences in order to generate feedback or instruction. Therefore a mere description is not enough. The knowledge contained in the models should be organized and linked to an inference engine. It is through the latter's interaction with the descriptive data that tutorial feedback is generated.

3. Computer Assisted Tutoring and Intelligent Tutoring System

Student module, Tutor module, Expert module, User Interface module are present in ITS [2, 12, 14, 17 and 18]. The relation between tutor module and student module is formed only once by designer when the system is designed and it is constantly used [8]. Which topics for a determinate student's level are given in which sequence is determined first of all and each time it is moved in accordance with these acceptances? However, designer's acceptances have a tempo labile, changeable with time, quality. That is why, the sequence of presentation and topic which are determined for a student model. It should be able to change if necessary after a few examples and the system should become more flexible. In available systems, as soon as the student starts his education, he forms a student model related to himself as a result of interacting with various devices measuring the readiness and continues his education in accordance with his own level and the dates in that model. A student with the similar level continues his education with the same topic and presentation sequence when he encounters the same measuring tools [9, 16, and 20].

In general, the programs which are carried out with computer-assisted tutoring are defined as programs in branched structure which continuously follow a previously specified structure depending on the feedbacks of students [7, 16, 20]. In computer-assisted tutoring, the answers which students give for questions are recorded and the necessary feedback is provided but this doesn't affect the flow of the program [7]. Student's learning styles, prior knowledge's and how they dominate the topic during the program aren't taken into account. Contrast to computer-assisted tutoring, ITS benefit from the information's three modules which are domain expertise, pedagogical theory and individual's qualities in order to provide the best learning [4, 9, 17, 20]. Domain expertise generally includes facts, relations, procedures, general mistakes and the strategies which are used by domain experts. Pedagogical theory contains the types of information and skill in order that the best learning is implemented. And the category of learners' qualities includes domain expertise proficiency, the misunderstandings about the domain, students' self-confidence on their proficiency, personal interests and learning tendencies.

ITS complete many deficiencies of computer-assisted tutoring and present students a better learning atmosphere [3, 7]. When generally compared, interaction with computer are made at high rate in the education which is carried out with ITSs, on the other hand, in computer-assisted tutoring, this interaction is restricted. By ITSs, students' weak and strong aspects are taken into consideration but a monotype tutoring is provided in computer-assisted tutoring. Directing and giving feedback with ITSs are performed by using artificial intelligence techniques but feedbacks and directions with computer-assisted tutoring are done for each student in a limited way without taking students' qualities into consideration.

4. Result and conclusion

Nowadays, ITSs are viewed as future's tutoring system and many studies accomplish in this area. When they are compared to other systems on catching up with the classroom atmosphere, ITSs are quite successful and by relatively taking students' place, they undertake supporting duty for students. Since ITS present a tutoring which is personalized according to students' personal information and behaviours, they put better results than computer-assisted tutoring. In computer-assisted tutoring, students' differences aren't taken into account. The same education program around previously formed framework is presented to each student. This situation causes each student to take education at the same level and it prevents presented education

from structuring according to students' individual qualities. ITS formed with artificial intelligence techniques eliminates this deficiency at a high rate. ITS have been contrasted to computer-aided learning systems. The comparisons display that ITSs have increased their learning quality as 43 percent and decreased their learning period as 30 percent. That the interaction in ITS is implemented at high level and that the feedback is provided at each stage helps the student to be evaluated more properly. That there are crowded classes in tutoring environments and so the communication between student and teacher isn't in sufficient level diminishes the education's quality. By Means of ITS, in these cases will give support to teacher and will provide students with learning in a better way. Also, that measurement and evaluation are implemented according to students' available information, learning styles and behaviours will put more positive results.

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