

# Appraise of Intelligent Tutoring Systems in E-Learning

Anagha A. Ralegaonkar<sup>1</sup>, Dr. S.B. Thorat<sup>2</sup>, Dr. P.K. Butey<sup>3</sup>

<sup>1</sup>Research Scholar, Department of Electronics & Computer Sci. RTMNU, Nagpur, Maharashtra, India

<sup>2</sup>Director, SSBES's, Institute of Technology & Management, Nanded-431602, Maharashtra, India

<sup>3</sup>HOD & Associate Professor, Computer Science, Kamla Nehru Mahavidyalaya, Nagpur, Maharashtra, India

## ABSTRACT

An e-learning system is ever more achieving popularity in the academic community because of several benefits of learning anywhere and anytime. Most frequently it gives the impressions for web-based instruction so that learners can access online courses via internet. One possible reason for the lack of success is that just placing lecture notes on the internet does not teach. This situation can be improved through the use of training software such as Intelligent Tutoring Systems (ITS). An ITS (Intelligent Tutoring System) is a complex, integrated software system that applies the principles and methods of artificial intelligence (AI) to the problems and needs of teaching and learning. They allow searching the student's knowledge level and possess learning strategies to enhance the students' knowledge. They are intended to support and improve the teaching and learning process in respect of the individualism of the learner. In the paper a review of intelligent tutoring systems (ITS) is given from the aspect of their application and usability in modern learning concepts.

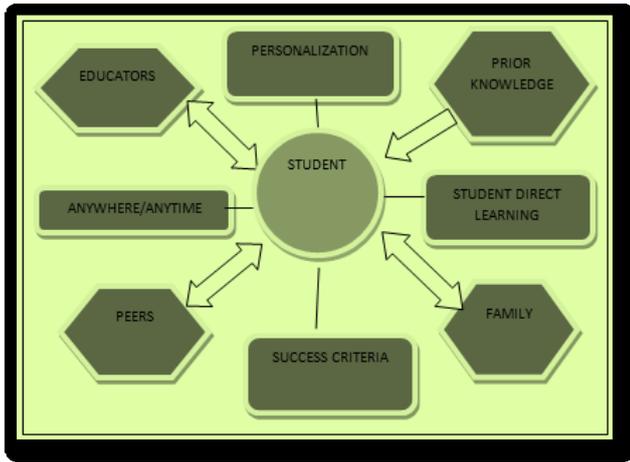
**Keywords:** Intelligent Tutoring System, teaching-learning process, web based learning, e-learning

## I. INTRODUCTION

In order to support the learning process of traditional teaching, or as a replacement for such a teaching with one of the new methods and ways of realization of the teaching learning process, information and communication technologies have become an essential part of the system. In that direction, multimedia, computer networking and programming engineering, have led to the emergence of a new generation of computer systems to learn. Modern information technology, especially computer networks, intranet, internet, and in particular hypermedia together contributed to the establishment of Advanced Learning Technology (ALT) [1, 2, 3, 4, 5].

And it leads to the learner centered approach which broadly encompasses methods of teaching that shift the focus of instruction from the teacher to the student [6, 7, and 8]. The student is placed in the center, while the surrounding learning resources such as prior knowledge, family background, teachers etc are shown in the figure 1.

E-learning systems are mainly web-based learning systems where learners can access online courses contents via Internet. In this era of information technology many systems are formed which are based on the stagnant teaching contents and describes much information to their users. But as an informational system it should adaptable and interactive so that teaching – learning process becomes more emphasized and fruitful. This idea gives birth to the development of tutoring shells for building intelligent tutoring systems (ITS), and access is provided by standard Web browsers. for open, flexible and distributed activities in the process of teaching and learning, we can have different systems such as Electronic Learning (e-Learning) , Advanced Distributed Learning (ADL), Intelligent Learning Environments (ILE), Mobile Learning (m-learning), Online Learning (OL), Open and Distance Learning (ODL), Remote Learning (RL), Web-Based Learning Environments (WBLE or WLE), etc [9,10].



**Figure 1.** Student-Centered Model

## II. INTELLIGENT TUTORING SYSTEMS (ITS)

Intelligent tutoring systems (ITS) are complex, integrated software systems that apply the principles and methods of artificial intelligence (AI) to the problems and needs of teaching and learning. They enable searching models of student level of knowledge and use learning strategies to increase or correction of students' knowledge. "Intelligent Tutoring Systems" [ITS] attempt to simulate such a "teacher", who guides the student's lesson flow, uses pedagogical methods suitable to a student and monitors progress on an individual basis, in an online setup based on his or her level of understanding in the subject. Basically approach is to record the "proficiency" of a teacher in the subject and the "perceptive" of the student in the subject, so as to deliver an effective personalized "instruction", in an online environment.

They are based on the development and implementation of methods and techniques of artificial intelligence (AI), and on that basis the content and method of teaching presentations of topics can adjust to individual abilities of the students. They are intended to support and improve the teaching and learning process in the chosen field of knowledge while respecting the individuality of the learner.

The purpose for applying computers in assisting instruction is to help students learn more efficiently. Traditional education systems instructing via computers are called Computer-Assisted Instruction (CAI) systems. CAI systems present instructional materials in a rigid tree structure to guide the students from one content page to another depending on their answers [11]. While traditional CAI systems may be somewhat effective in

helping learners, they are restrictive in that they do not consider the diversity of students' knowledge states and their particular needs [13]. This drawback has prompted a promising direction in the application of Artificial Intelligence techniques in education known as Intelligent Tutoring Systems (ITSs) [14]. Intelligent Tutoring Systems are computer-based programs that present educational materials in a flexible and personalized way that is similar to one-to-one tutoring. Scientific field of research of artificial intelligence started in 1970s Zhang, Ren and Chen [5], intelligent tutoring systems are a direct product of such research. ITS is an informed process which supplies individualized tutoring or net established guide for scholars and is established on smart retailers. One of these procedures can respect the pupil characteristics like skills, behavior, and even emotions.

ITSs are based on knowledge because they have:

- 1) knowledge they have about the domain knowledge;
- 2) knowledge of the principles by which the is taught;
- 3) Methods by which to apply these principles and knowledge of methods and techniques for modeling the flow of students to acquire knowledge and skills.

The traditional intelligent tutoring system (ITS) was built based on four interrelated software modules [15, 16, and 17] and they are:

- 1) Student module (SM) The student module contains descriptions of student knowledge or behaviors, including his misconceptions and knowledge gaps
- 2) Teacher module (TM) A mismatch between a student's behavior or knowledge and the expert's presumed behaviors or knowledge is signaled to the tutor module, which subsequently takes corrective action, such as providing feedback or remedial instruction with the help of pedagogical module. This module contains the information which includes tutoring strategies and tactics which are stored in knowledge module.
- 3) Domain module (DM) The Knowledge module references an expert or domain model consist of a description of the knowledge or behaviors that represent expertise in the subject-matter. It is the module in which main information and tutorial information that are going to be taught resets.
- 4) User Interface (UI) The user interface module provides the means for the student to interact with the ITS, usually through a graphical user interface.

### III. A REVIEW OF DEVELOPED INTELLIGENT TUTOR SYSTEMS (ITS) IN EDUCATION

Below is a list of intelligent tutoring system (ITS).

**Adil (Automated Debugger in Learning System)** is a software system for automated debugging based on knowledge, designed as an intelligent tutoring system (ITS). It assists students in mastering basic debugging skills of their programs, as a target for the C programming language. It localizes bugs and explains to these programs. Given a syntax error-free program and its specification, this debugger called Adil (Automated Debugger in Learning system) will be able locate, pinpoint and explain logical errors of programs. If there are no errors, it will be able to explain the meaning of the program. Adil is based on the design of the Conceiver, an automated program understanding system[18].

**ELM-ART (ELM (Episodic Learner Model) – ART (Adaptive Remote Tutor))** is a Web-based intelligent tutoring system (WITS) designed for teaching students programming in LISP (List Processing) programming language. It integrates intelligent educational system with electronic textbook program in a unique environment in which the user can broaden and deepen previously acquired knowledge. It was used as an intelligent interactive electronic textbook on programming in LISP programming language logic [30].

**ADIS (Animated Data Structure Intelligent Tutoring System)** is a Java-based Web-enabled intelligent tutoring system (ITS) developed as a teaching support to enhance students' understanding of data structures such as linked-lists, stacks, queues, trees and graphs. ADIS has the capability to display data structures graphically on the computer screen as well as allowing graphical manipulation of the data structure created. There is a tutorial mode incorporating exercises, where students can learn basic algorithms (insertion, deletion etc.) of data structures visually[19].

**KERMIT (Knowledge-Based Entity Relationship Modelling Intelligent Tutoring)** is an intelligent tutoring system (ITS) for entity-relationship (ER) modelling. Database design is an open-ended task: although there is an outcome defined in abstract terms, there is no procedure to use to find that outcome [22,23,24].

**ML-Tutor (Machine Learning Tutor)** is a Web-based client server system which has been built with the intention of combining Internet technology with educational hypertext. The client component of the system incorporates the user interface and runs in a WWW browser. The client captures data which are transmitted to the server using Internet technology. The server component of the system is executed when requested by the client [25].

**DM-Tutor (Decision-Making Tutor)** is a constraint-based tutor intelligent tutoring system (ITS) which is embedded within an existing system, the management information system (MIS) for oil palm plantation management. The goal of DM Tutor is to provide scenario-based training using real-life operational data and actual plantation conditions. The goal of DM-Tutor is to help users apply theoretical concepts of plantation analyses into real-life plantation decision-making[20,21].

**NORMIT (Normalisation Intelligent Tutor)** is an intelligent tutoring system (ITS) that teaches database normalization to university students. NORMIT is a Web-enabled system, and its architecture and techniques are used to deal with multiple students [26, 27].

**WITS (Whole-Course Intelligent Tutoring System)** is an intelligent tutoring system (ITS) and expert system (ES) that teaches a course on solid state electronics independently of a human teacher. It is able to offer a learning environment that motivates learners and gives useful instant feedback to learners [29].

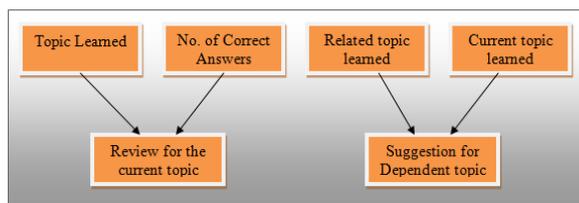
**SQLT-Web (SQL-Tutor (Structured Query Language Tutor)** on the Web) is a software intelligent tutoring system (ITS), based on knowledge, which is a SQL-Tutor independent system for teaching and learning SQL query language databases [28].

**KITWEB:** We have developed KITWEB, Knowledge Based Interactive Tutoring System for WEB application testing. KITWEB is intelligent tutoring system based upon the Bayesian networks and constraint based modeling. KITWEB evaluates the student's knowledge by using different constraints and suggests the next testing technique to be learned to their users by using Bayesian networks. BN works with KITWEB by calculating knowledge gain of the student by observing

the student how does he /she solve the current testing practice and how does he/she answers the questions. This is shown in fig.2.

#### IV. CONCLUSION

E-learning is an amalgamation of information and communication technology and education. An e-learning system is increasingly gaining popularity in the academic community because of several benefits of learning anywhere and anytime.



**Figure 2.** BN implemented in KITWEB

These systems become valuable when used as part of a well-planned and organized environmental education. By using different techniques of AI E-learning becomes a new standard of learning with the help of different devices based on electronic technology, for individualized teaching and learning Intelligent tutoring systems during today's application have helped improve the teaching process adjusted to the individual needs of students and have proven expediency in education. ITS integrates built-in expert systems in order to monitor the performance of a learner and to personalize instruction on the basis of adaptation to learners' learning style, current knowledge level, and appropriate teaching strategies in e-Learning systems. As a special class of e-learning systems, intelligent tutoring systems support and improve the learning and teaching of domain specific knowledge, respecting learner individuality as in traditional one-to-one tutoring. The conceptual results show that this innovative approach is helpful to the learners in improving their learning achievements.

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