Mathematics intelligent tutoring system

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Abstract
In these days, there is an increasing technological development in intelligent tutoring systems. This field has become interesting to many researchers. In this paper, we present an intelligent tutoring system for teaching mathematics that help students understand the basics of math and that helps a lot of students of all ages to understand the topic because it's important for students of adding and subtracting. Through which the student will be able to study the course and solve related problems. An evaluation of the intelligent tutoring systems was carried out and the results were encouraging.

Keywords: intelligent tutoring system, e-learning, mathematics

1. Introduction
Intelligent tutoring systems (ITSs) have been investigated in AI now for several decades. With the enormous development and increasing availability of the program, the application of intelligent learning systems becomes more probable and accurate and research for intelligent features obtains more care than before. As a result, a number of new ITS have been established over the last years, program, and web page [28].
This project is based adaptive learning environment for mathematics. These systems strive for improving long-distance learning, for complementing traditional classroom teaching, and for supporting individual and life-long learning, and allow a user to learn in his own environment and whenever it is appropriate for him [28].

2. Literature Review
There are many ITS that were developed for: ITS for Learning Java Objects [4], ITS teaching grammar English tenses [10], Java Expression Evaluation [3], Linear Programming [23, 26, 27], ITS for Teaching Mongo Database[18], ITS for C# Language [7], effectiveness of e-learning [5, 31], effectiveness of the CPP-Tutor [25], teaching AI searching algorithms [30], teaching database [24], and ITS for Teaching the 7 Characteristics for Living Things [17], ITS for teaching the right letter pronunciation in reciting the Holy Quran [6], ITS for Health problems related to addiction of video game playing [8], ITS for teaching advanced topics in information security [19], Oracle Intelligent Tutoring System (OITS) [9], ITS for learning Computer Theory[14], e-learning system [29], ADO-Tutor: Intelligent Tutoring System for leaning ADO.NET [15], ITS for Parameter Passing in Java Programming [22], and Predicting learners performance using NT and ITS [27], CPP-Tutor for C++ Programming Language [20], a comparative study between Animated Intelligent Tutoring Systems (AITS) and Video-based Intelligent Tutoring Systems (VITS) [21], ITS for stomach disease Intelligent Tutoring System [13], ITS for diabetes [12], Computer Networks [11], DSE-Tutor for Teaching DES Information Security Algorithm [16].

3. ITS Architecture
In this paper, we used ITSB authoring tool [28]. This tool designed and developed by Professor Samy S. Abu Naser [28].

He used Delphi Embarcadero XE8, 2015 [2]; this tool supported two languages: English and Arabic and has two systems in one application. The first system is the teacher system where it allows the teachers to add course materials, questions and answers. The second system is the student system where it allows the student to study course materials and answer exercises.
This tool contains four modules: domain module, teaching module, student module and user interfaces module. The first module stores and organizes the material in chapters or lessons. The second module works as control engine. The third module gives the system all essential information so it can adapt itself to the student. The last module has two sections - one for the student and the other for the teacher as shown in Fig 1.
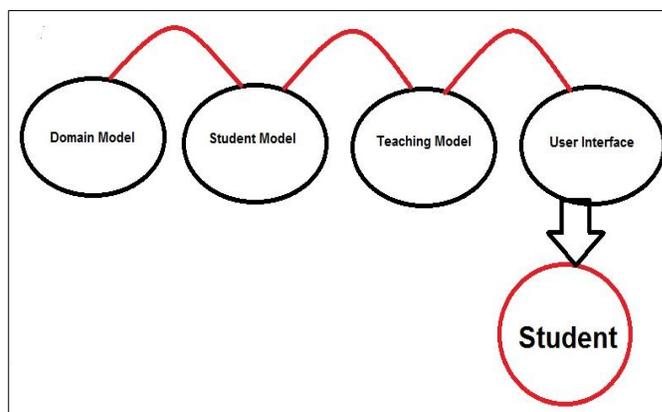

Fig 1: Overall System Architecture

3.1 Domain Module
This model deals with many important topics of interest in the System for Mathematics. The topics covered in intelligent tutoring system are:
- Algebra
- Real numbers
- Integer Exponents
- Roots of real numbers
- Rational exponents
- Radicals polynomials,

- Addition and subtraction and
- Factoring second degree polynomials**.**

3.2 Student Module

A new student account must be created to have a profile where it allows the student to study course materials and answer the exercises. The profile has information about the student such as student name, last session date, student number, current score, overall score, level of difficulty, and problem number during the each session. The current score represents student score for each level. The overall score represents student score for all levels.

3.3 Teaching Module

Teaching module works as a manager that controls the functionality of the entire system. Through this module, a student can answer questions on the first level of difficulty and if he/she gets 75% mark or more, he/she can move to the next level. But if he/she fails to get the marks, he/she repeats to the exercises of the same difficulty level again.

3.4 User Interface Module

The ITSB tool used for building the current ITS system has an interface that supports two classes of users: teachers and students. When the teacher's log into the system, the teacher can add/modify lessons, exercises, answers, initial information about the student, configure/adjust the color, font name, and size of all buttons, menus, and combo boxes. Therefore, this interface provides the system with the required heftiness and suppleness. A screenshot of the teacher's interface is shown in, Fig 4, Fig 5 and Fig 6.

But when the student logs into the system, he/she can study the lessons, examples, solve the exercises for each lesson. A screenshot of the students interface can be seen in Fig 2, Fig 3, Fig 9, and Fig10**.**
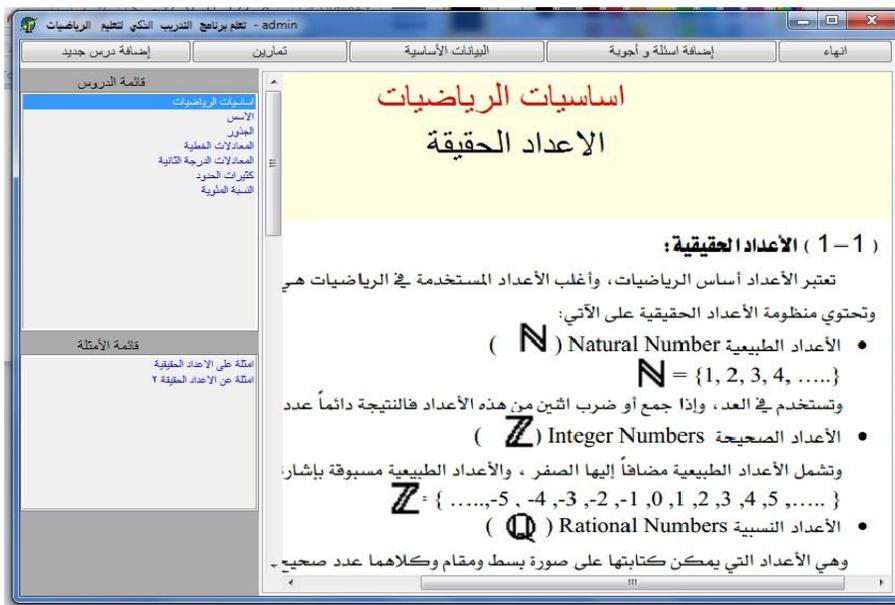

Fig 2: Student lessons form.
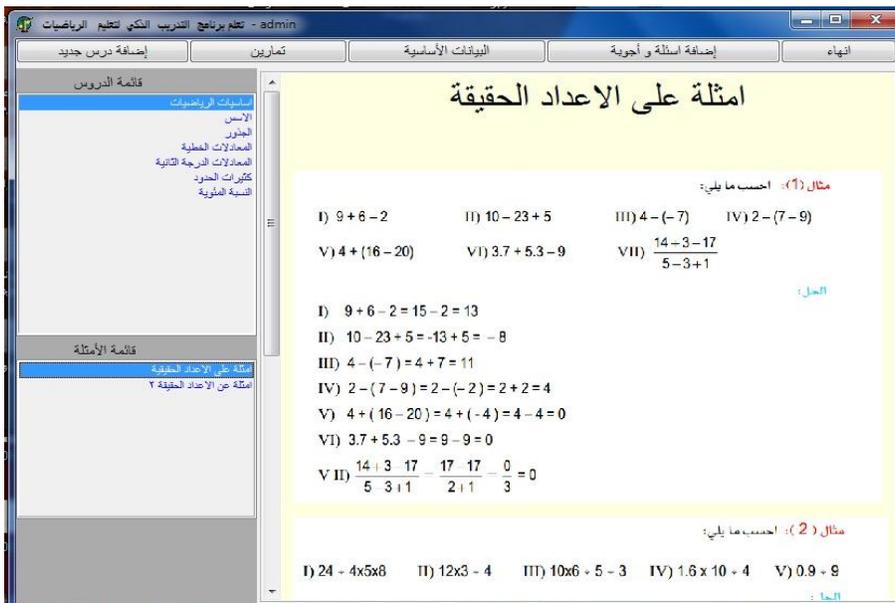
Fig 3: Student lessons and examples form

Fig 4: Form for adding Lessons and Examples

Fig 5: Form for adding constants of the system

Fig 6: Form for adding initial students' information

Fig 7: Form for adjusting Fonts of all screens of the system
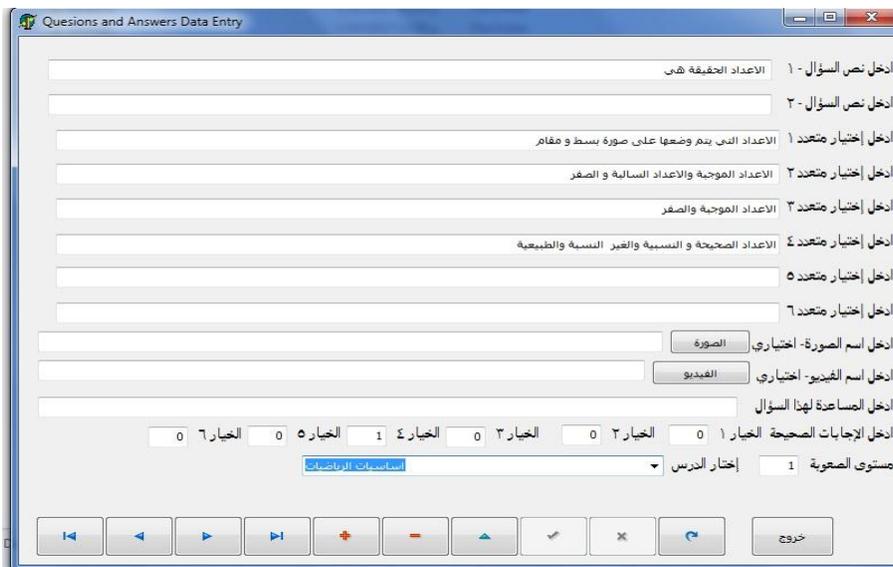
Fig 8: Form for adding questions and answers

Fig 9: Student Exercises form

Fig 10: Student statistics form.

4. Evaluation

We have asked the students who are interested in trying an Intelligent Tutoring System for Mathematics. Almost all students welcomed the idea. After trying the intelligent tutoring system for mathematics, they expressed their felling of the system. They said it is easier for them to study using the new system and it is very efficient in terms of the material and exercises and the difficulty levels of the questions.

5. Conclusion

In this paper, we have designed an Intelligent Tutoring System for teaching Mathematics by using ITSB authoring tool. The system was designed to facilitate the learning Mathematics to overcome the problems students face during their study.

An initial evaluation of the intelligent tutoring system as done using a group of students and the results of the evaluation was encouraging.

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