Design and Development of Diabetes Intelligent Tutoring System

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Abstract:

This paper describes the design of a desktop based intelligent tutoring system for teaching diabetes to the student to overcome the difficulties they face. Intelligent Tutoring Systems purposed to provide immediate and customized instruction or feedback to learners. One of a teacher jobs is preparing materials to the students then explaining it, this system will save time for teachers and students, and they can reach it when and where they want to, so it will help individualized learning. This system supports the concept of recent health strategy, skilled patient who has developed a high level of knowledge and expertise to enable them to manage and control their own conditions. The researchers designed and developed the system using clinical medicine books, doctors, and questioners. The system helps students to deeply understand diabetes and diagnose it by explaining its types and shows the reasoning for each one. An initial study was done to measure the effect and performance of using intelligent tutoring system on the students. Evaluation of the system has shown pretty satisfactory results and positive effects as far as its learning capabilities and usability are concerned.

Key words: Intelligent Tutoring System, ITS, Diabetes, Artificial intelligence, Expert System

INTRODUCTION

Nowadays, with the 21st century's, computers act as an essential part in the education-instruction. Beside computer has come into our life, learning decision, independent from time and place, is executed in an effective structure. Also, software that show students effective instruction and guided method and provide education with suitable adapted to student to begins to be developed. The most important software category which is developed with this aim is ITS which is formed by using computer Technologies and AI. ITSs are tutoring systems which are formed with using AI techniques in computer programs to facilitate instruction. These systems are based on cognitive learning theory which is a learning theory interested and concerned in how information are organized and managed in human's memory. ITSs are intelligent programs which know what, how and whom they will teach and educate depends on student situation [5,6].

Traditional education is concerned with student attending class and focusing with the teacher, if the student did not understand the lesson, the teacher will repeat it and this will increase teacher jobs and should spend more times with the students, also preparing quizzes and exams then resolve students problems, preparing for assignments then correcting it, the most important thing is student cannot repeat the lesson at home alone and test his knowledge and may be self-learning. Because of this we need ITS to help students and teachers to save time and work less in return for the lesson more than once[7,8,9].

The intelligent tutoring system for diabetes was designed and developed using ITSB authoring tool [16].

There are two types of diabetes: type 1 and type 2 Diabetes Mellitus[1]. Insulin-Dependent Diabetes Mellitus and Non-Insulin Dependent Diabetes Mellitus. Insulin resistance and insufficient insulin production[3].
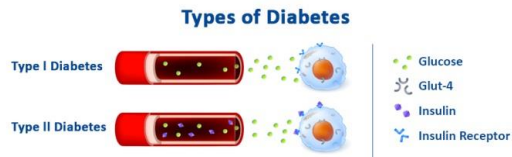

Figure 1 Types of Diabetes - Designed by Suheir H. ALmurshidi.

LITERATURE REVIEW

There are various research papers and ITS applications that have been developed in education and medical fields. Gujarathi and Sonawane [2] presented a mobile application case study to take the benefits of mobile devices by developing an Intelligent Tutoring System that mentors diabetics, giving them the ability to develop the necessary expertise. There are many intelligent tutoring systems designed and developed for the education purposes. Some of these ITS dedicated to teaching like [6-8. 11-12,15,17-19], ITS developed to assist students in learning logic and helps students to learn how to construct equivalent formulas in first order logic (FOL)[1], Teaching Java objects Programming language[17], CPP-Tutor for helping Computer Science students to learn C++ Programming Language [7], ITS for helping English Language students to teach English Language [15], Java Expression Evaluation [9], Linear Programming[5,13], effectiveness of e-learning[18], computer aided instruction[6], effectiveness of the CPP-Tutor[19], teaching AI searching algorithms[8], teaching database to sophomore students in Gaza[12] Predicting learners performance using NT and ITS [14], and intelligent tutoring system for teaching advanced topics in information security[11], A comparative study between Animated Intelligent Tutoring

Systems (AITS) and Video-based Intelligent Tutoring Systems (VITS) [10], An agent based ITS for Parameter Passing In Java Programming[20].
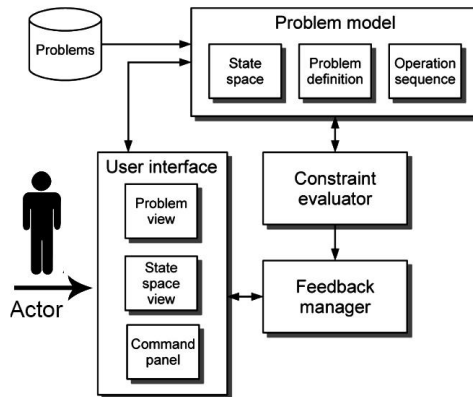
ITS ARCHITECTURE

Figure 2: This is a typical architecture of the Intelligent Tutoring System.

This Intelligent Tutoring System for Diabetes contains problems: problem model (state space - problem definition - operation sequence), and user interfaces (Problem view - state space view, Command panel). And process in which the affect output of an action is feedback manager, and Constraints on Evaluations.

DOMAIN MODEL

The domain model is concerned with the lessons, its arrangement and a range of elements. The material covered in this ITS as follows[3-4]:

- Reasons of Diabetes
  - lesson 1: Syndrome Diabetes
  - lesson 2: Examinations and Tests Diabetes
  - lesson 3: protection Diabetes
  - lesson 4: Therapy Diabetes

- o lesson 5: Alternate names Diabetes
- o lesson 6: Possible complications Diabetes
- Eye Care
  - o lesson 1: You Need Regular eye Exams
  - o lesson 2: How to Prevent eye Problems
  - o lesson 3: Make it Easier for Yourself at Home
  - o lesson 4: When to Call the Doctor
  - o lesson 5: Alternative Names
- Foot ulcers
  - o lesson 1: Debridement
  - o lesson 2: Taking Pressure off Your Foot Ulcer
  - o lesson 3: Wound Care and Dressings
  - o lesson 4: When to Call the Doctor
  - o lesson 5: Alternative Names
- Low blood sugar - self-care
  - o lesson 1: Recognizing low Blood Sugar
  - o lesson 2: Check Your Blood Sugar Often
  - o lesson 3: Preventing Low Blood Sugar
  - o lesson 4: When Your Blood Sugar Gets low
  - o lesson 5: Talk to Your Doctor or Nurse
- Diabetic diet - gestational diabetes
- To prevent heart attacks and stroke
- Resources
- Take care of your feet
  - o lesson 1: Blood Pressure
  - o lesson *2*: Before you Exercise
  - o lesson *3*: Taking Aspirin may Help
  - o lesson *4*: Cholesterol
- Tests and examinations
- when you are sick
  - o lesson 1: Sick-day Plan
  - o lesson *2*: Drink Lots of Fluids
  - o lesson *3*: Eating When you are Sick
  - o lesson *4*: Diabetes Drugs

STUDENT MODEL
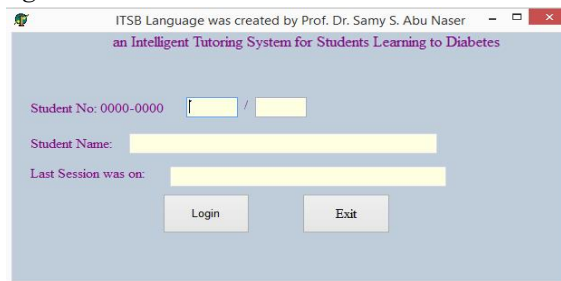
Every new student must have his own account to have a profile where it allows the student to study course materials and do the exercises. The profile has information about the student such as date of last visit, student name, student number, current score, and overall score. The current score represents student score for each level. The overall score represents student for all levels.

PEDAGOGICAL MODEL

It works as a coordinator that controls the functionality of the system .Through this model, a student can answer questions on the first level and if he gets 75% mark or more, he can move to the second level. But if he gets low marks, he repeats the examination at the same level.

USER INTERFACE MODEL

The user interface of the intelligent tutoring system is shown in figure 3 to figure 10.

Figure 3: Student Login Form.

Figure 4: Form for adding ITS Basic Data.

Figure 5: Form for adding Students Data

Figure 6: Form for adjusting Fonts Name, color and Font Size of all screens of the system.

Figure 7: Form for adding questions and answers

Figure 8: Student lessons and examples form.

Figure 9: Student Exercises form.
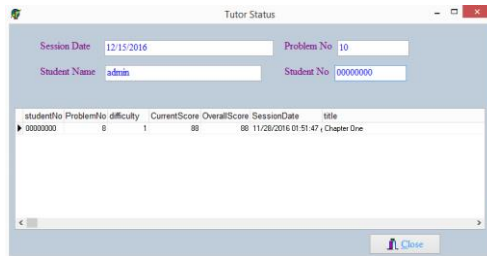
Figure 10: Student statistics form.

ITS EVALUATION

An initial evaluation was done for the system by teachers and their students', additional a specialist doctor to evaluate the system from different perspectives and it is done by dividing the evaluation into two stages. First stage for teachers and students by dividing them for two groups and take feedback from them after presenting the system for each group to review lessons, examples, questions and answers, concerning on the design, how is the efficiency for the system and ease of use.

Second stage for a specialist doctor to review the content of the system and the order of the material then giving their feedback.

The result of two stages was positive and they gave a positive impact result, the result collected by using interviews and questioners to take their opinions. The results are shown in Table1.

Table 1: shows the result of the two stages.

S.	Item	Rating %
1	The Quality of the Design?	86%
2	The System is efficient?	90%
3	Did you find user interface of the system helpful?	89%
4	Would you like to see similar tutoring system in other courses?	92%
5	The System is friendly	91%

CONCLUSION

ITSs are viewed as future's tutoring system and many studies accomplished in this area. When they are compared to traditional classroom atmosphere, ITSs are quite successful and relatively taking teachers' place, they take on supporting duty for students. In traditional teaching environment, students' differences aren't taken into account.

In this paper, we have designed developed an intelligent tutoring system for students learning diabetes using ITSB authoring tool. The system was developed for students who want to study medicine or increase their knowledge in this field easily and smoothly. System architecture and requirements of students and teachers were taken in consideration of the design of the system. The evaluations of the system have been done by specialist doctors, teachers and students.

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