Intelligent Tutoring Systems -An Advanced Understanding of the Programming Concepts

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Abstract - **Intelligent Tutoring Systems (ITS) could provide an excellent one-on-one support to improve students' conceptual understanding [14]. The structure of a traditional ITS had four combined modules: the knowledge module, the student's modules, the instructor's module, and the end user module. In this paper, the old structure is modified to improve the concept of understanding the programming. The changes that we include to the traditional structure were the Knowledge Evaluation Module and the Reporting Module [14]. The reporting module is created to understand each student's learning levels from different instructors who can see the result of their knowledge level as the system assesses and tutors every student [13]. According to the use of the knowledge Evaluation module the instructor can add changes in quizzes or lectures content [13]. Those new updated modules are expected to improve the highly perform in the intelligent tutoring systems and are considering being one of the major achievements in the current proposed work [13]. A case study is being implemented to show the study of the systems design for the students' understanding [13]. Several sessions of professional development training are being conducted for faculties whom are interested to improve their students' knowledge level of using the developed tool [13].**

Keywords - **Intelligent Tutoring Systems, Knowledge Evaluation Module, Reporting Module**

I. INTRODUCTION

ITS can provides a supportive to improving students' mutual understanding of different topics [14]. It has many advantages over Computer Assisted Instructions old systems [13], may sometimes lack the adaptability of instruction during the tutoring process as well as the precision of identification of conceptual misunderstanding. They do not consider the diversity of users' knowledge states, and as a result they did not provide flexibility of instruction plans that could handle such diversity [1, 2, 3, 4, 13]. In other methods, many researchers developed several projects that utilized ITS in many areas. For example, some worked on improving students' understanding of mathematics in order to enhance students' achievements in high-stakes standards-based tests (K-12) [5, 6]. Others focused on assisting Computer science graduate students studying programming courses. Not only that, but their system situated students in a virtual environment as if they have already graduated, hired, and required to solve real life problems [7]. Another group of researchers tackled practical, real life, problems such as Auto Tutor that handled teaching driving [8] as well as training Control Center operators in tasks like incident diagnosis and service restoration of power systems [9]. However, the aforementioned ITS structures needed to have components that enable instructors who use the system to understand students' interaction with the system. Not only that, but teachers need to be able to modify their method of assessment as they design system quizzes or lectures according to students' learning status. In our research we propose an ITS that is capable of assisting teachers as they help their students understand different topics in academia. Section two gives an idea about the structure of the traditional ITS describing its different modules as well as the relationship among those modules [13]. In third section introduces the idea behind the modified ITS and the anticipated improvement over the traditional ITS structure. Section four puts the new design into play as it discusses the its deployment in an ITS that helps students understand programming concepts. The paper wraps up with section five which discusses future research directions and ends with section six as the conclusion.

II. AIM

ITS is expected to evaluate and reasoning within the knowledge represented in this knowledge domain [13]. The student module contains the information about the student being tutored. This information can be about the student's wisdom level on the topic being taught as well as the student's learning attitudes [13].

III. METHODOLOGY

In general, ITS comprise four subsystems: the knowledge domain, the student's modules, the instructor's module [13], and the presentation module [10, 11]. Those subsystems interact in a unique way to guide the teaching and learning process (see Figure 1). A continuous and timely feedback is provided as the system assess student's learning progress. Eventually, this continuous process is expected to improve student's conceptual and procedural understanding. The knowledge domain stores the learning materials needed for students' tutoring. The ITS is expected to evaluate and reasoning within the knowledge represented in this knowledge domain. The student module contains the information about the student being taught [13]. This information can be about the student's wisdom level on the topic being taught as well as the student's learning attitudes.

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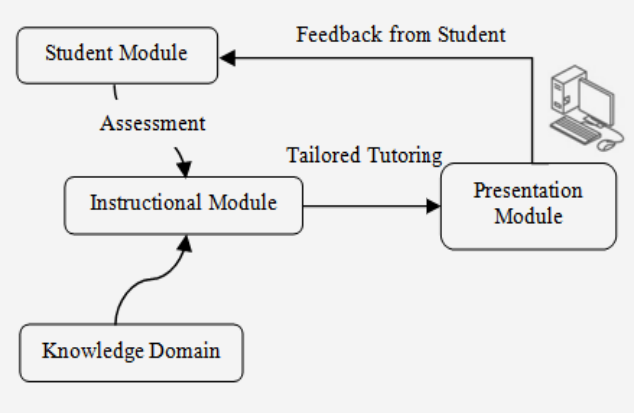

Fig 1 Traditional ITS structure

As mentioned earlier, the structure of a traditional ITS encompasses four modules: the knowledge module, the student's modules, the instructor's module, and the End user module. In our opinion, that structure need to be modified to allow adaptability of the overall system. There must me a method to modify the knowledge module to allow the designed system to deal with a wider spectrum of students` learning styles. The modification that we added to the designed ITS is the knowledge manipulation module. Using that module the instructor/administrator can add, and changes in quizzes or lectures content (see Figure 2). Therefore, both of the knowledge domain and the knowledge Evaluation modules constitute the Adaptive Knowledge Module. In addition, the reporting module has been created to find every student's learning levels from different instructors [13], which in turn can see the result of their knowledge level as the system assesses and tutors each student [13]. Those new updated modules are expecting to improvement to the overall performance of traditional intelligent tutoring system. The following case study will shed some light on the benefit of using the new ITS design in an application in academia.

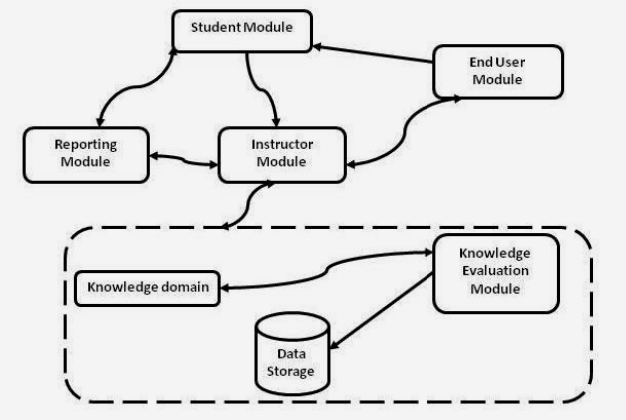

Fig 2 Data flow diagram an updated ITS structure

In this research the end user interface plays an important role of communicating with the student who is using the system [13]. The quizzes sections are separated from the feedback section [13]. In addition, a Bayesian networks mechanism decides which concepts are understood or misunderstood. During that process simple feedback screens cascade in to repeat the understanding process. Overall, as students interact with the designed ITS quizzes, the system collects information about the level of students' understanding. There are several levels to achieve the required result with each user: administrator, instructor, and student.

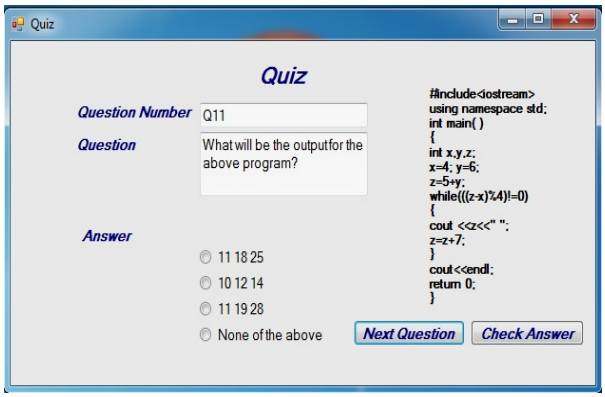

Fig 3 Quiz screen

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IV. CASE STUDY

We deployed the modified ITS design in an ITS for teaching students to understand the programming. The first design of this ITS was designed based on the traditional ITS structure [12, 13]. However, in this proposed research the design is modified by including the knowledge Evaluation module and the reporting module. Those modules became handy as they assisted instructors to modify their pedagogical strategies. For example, it was decided by the instructor that adding a program in the quiz will benefit students who are visual learners (see figure 3). In the previously designed system that component did not exist. However, the reporting module along with the feedback supplied assisted the instructor to change, or adapt, pedagogical strategies to fit with different students learning styles. In this research the end

user interface plays an important role of communicating with the student who is using the system [13]. The quizzes sections are separated from the feedback section. In addition, a Bayesian Networks mechanism decides which concepts are understood or misunderstood. During that process simple feedback screens cascade in to repeat the understanding process. Overall, as students interact with the designed ITS quizzes, the system collects information about the level of students' understanding. Figure 4 depicts a flow chart that is explaining how system-user interaction and data are following by sequence in the designed ITS. As illustrated, there are several levels to achieve the required result with each user: administrator, instructor, and student.

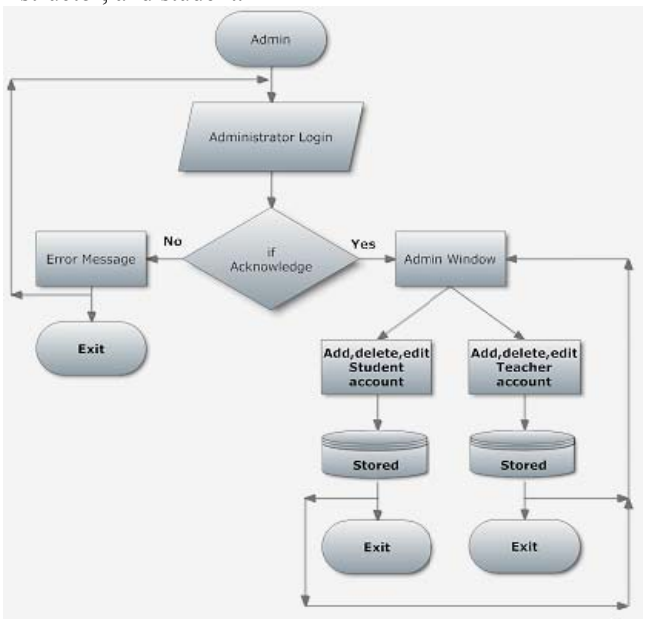

Fig 4 Flow chart for Administrator

V. MAIN RESULT

As student logon the system using username and password his account gets verified. After logging into the system, he enters the selection page to decide what he wants to do: solve a quiz, read a lecture, view a report, or exit. As he interacts with the system, the system stores necessary information about points of strength and weaknesses. When the instructor inquires about student level of understanding, he types student number to view the status of that student. Consequently, a sub module contains student progress is generated by database according the student number. The student has a similar choice of generating a report about his level of strengths and weaknesses. That enables the student to have ownership over his learning and gradually fix that by reading more lectures and then retake other quizzes (see figure 5). The overall process whether by reporting or adapting the knowledge through the knowledge manipulation module are considered valuable tools for both students and instructors, as mentioned earlier, this tool is expected to improve students' conceptual understanding. On the other method improve their pedagogical strategies which eventually will make them better instructors for their students.

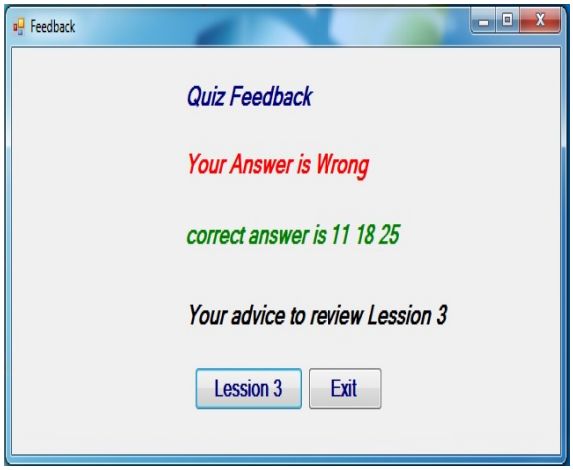

Fig 5 Feedback screen

VI.WHAT IS NEXT

In addition to the amount of effort spent on the current research to make it durable, there are few changes that could follow to future research [13]. For example of designed ITS has to be tested using a real experiment where students interact with the components. As well statistical analysis could follow to judge the merit of the designed system. Before doing that, a pilot test has to take place to make sure that the assumed as well as the calculated CPDs lead to a better judgment on student's level of understanding despite the present uncertainties within the Bayesian Network [13]. Unfortunately conducting such experiment at the mean time is a challenge that requires budget approval as well as sample time to conduct proper experiment. However, despite that limitation, the current designed research, in its context [13], is a valuable tool that could improve students' understanding. It is worth mentioning that the primary implementation of this research is in VisualBasic.NET on standalone machines. One of the future goals of the proposed research is to facilitate the use of the ITS as an e-learning tool. Therefore, suitable adjustments are planned to facilitate achieving that goal. As well, adding other Programming methods will be taken into consideration to deal with more variables in the design process. Finally, elevating the programming level to embrace sequential programming logics is an ultimate goal that will improve the effectiveness of the proposed ITS as it guides students' learning [13]. Again, it would be more productive in an experimental designed to test the effect of the use of the proposed ITS on students' understanding of programming. Such experiment could be implemented on two different groups, where the control group is exposed to regular class teaching techniques [13]. On the other hand, the experimental group is advantaged by being exposed to the proposed ITS in addition to the

regular class teaching techniques. It is expected that the achievement of the later group would exceed the former.

VII. CONCLUSION

The proposed research is a framework for an ITS that is anticipated to support students with diverse learning styles to Understanding of the Programming Concepts, such remedial is expected to improve students' understanding as well as to correct different misconceptions that student may have. These corrections are highly desirable especially when instructors try to build upon concepts already mastered by the ITS. Moreover, the reporting module supports the teacher with an updated status of his students. Therefore, he can review his quiz design or feedback lecture content used for remedial. Eventually, the overall process will help students to have better understanding and instructors to have better pedagogical strategies. On the other hand, Bayesian Networks showed this is a reliable technique to deal with different riskiness occurs during the student knowledge assessment [13]. Finally, building an ITS that deals with a learning problem during writing programs is a novel approach and is expected to improve the understanding of a wide range of learners. As for instructors, the designed ITS is a valuable assessment tool that will enable them to identify misconceptions as well as improve understanding leads to develop of individuals who has [13] a solid foundation in programming.

ACKNOWLEDGMENT

It is one of the future research is to facilitate the use of the ITS as good in an e-learning tool. Therefore, it will help the students to learning of the programming concepts, while many individuals assisted with a specified task, the whole project benefited from their time, efforts, energy, and expertise.

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