An intelligent tutoring system for teaching the 5 Human Senses

Ugwuja, Nnenna Esther;
Omankwu, Obinnaya Chinecherem;
Ubah, Valentine
Department of Computer Science
College of Physical and Applied Sciences
Michael Okpara University of Agriculture,
Umudike, Umuahia, Abia State

Abstract
Recently, due to the rapid progress of computer technology, researchers develop an effective computer program to enhance the achievement of the student in learning process, which is Intelligent Tutoring System (ITS). Science is important because it influences most aspects of everyday life, including food, energy, medicine, leisure activities and more. So learning science subject at school is very useful, but the students face some problem in learning it. So we designed an ITS system to help them understand this subject easily and smoothly by analyzing it and explaining it in a systematic way. In this paper, we describe the design of an Intelligent Tutoring System for teaching the 5 Human Senses smoothly. The system will provides all topics of living things and generates some questions for each topic and the students should answer these questions correctly to move to the next level.

Keywords: *Intelligent Tutoring System, Expert system, The 5 Human Senses*

Introduction

Intelligent Tutoring Systems use Artificial Intelligent skills and methodology to the development of computer-based learning systems so as to build adaptive systems. An ITS emphases education as a course of collaboration among tutor and student in which the tutor attempts to demonstrate concepts to the student. Generally, the procedure is controlled by the tutor, who needs to investigate the behavior, the knowledge and the satisfaction of the student. The tutor has to regulate and apply the more suitable teaching approaches at every minute. These strategies must answer a sequence of questions to guarantee that the learning process is carried out effectively. These questions are: what detail level is

necessary, what to explain, when and how to interrupt the student and how to detect and to correct errors [5].

One trademark of the field of AI and education is by means of intelligence to reason about teaching and learning. Representing what, when, and how to teach necessitates foundation from within a few academic disciplines, containing computer science, education, and psychology [6]. Several methods and tools of computer science, education, and psychology are complementary and jointly supply closely comprehensive coverage of the field of AI and education as seen in Figure 1 [7].

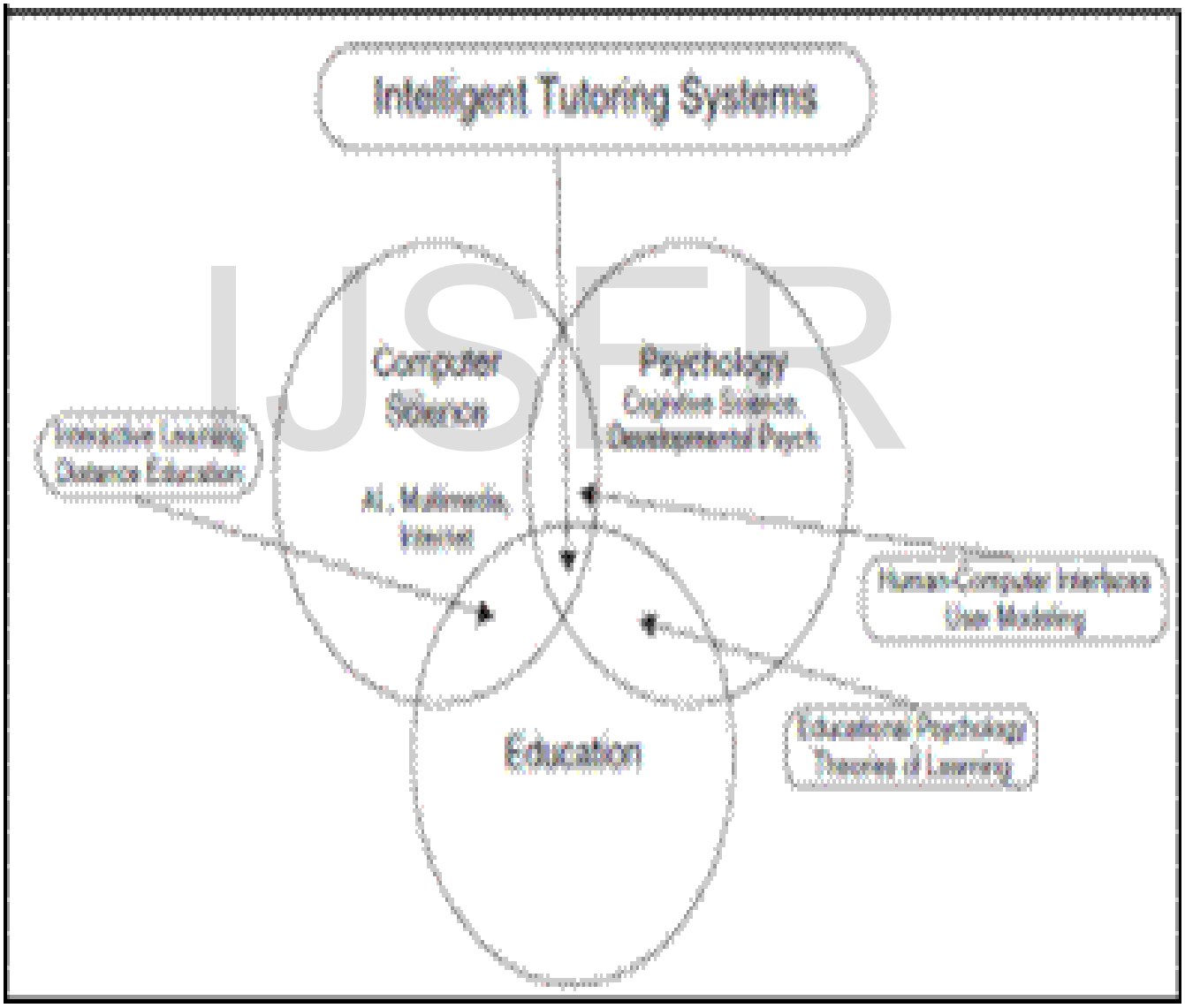

Fig 1: The field of AI and education is grounded in three disciplines: computer science, psychology, and education

The aim of this paper is the design of an intelligent tutoring system to teach the 5 Human Senses using Intelligent Tutoring System Builder (ITSB). ITSB is a tool designed and developed to assist teachers in building intelligent tutoring systems in multidisciplinary areas [6

2. ITS Architecture

The main four basic components that classically are identified in Intelligent Tutoring System are: domain module, pedagogical module, student module, and dialogue module.

2.1 Domain Module

Domain module represents expert knowledge, or how experts perform in the domain. The content of the 5 senses for human being are presented in the ITSB format to be suitable for presenting for the students.

There are some activities which make organisms different from non-living things. Humans have five basic senses: touch, sight, hearing, smell and taste. The sensing organs associated with each sense send information to the brain to help us understand and perceive the world around us. People also have other senses in addition to the basic five. Here's how they work.

1. **Touch:** Touch is thought to be the first sense that humans develop, according to the Stanford Encyclopedia of Philosophy. Touch consists of several distinct sensations communicated to the brain through specialized neurons in the skin. Pressure, temperature, light touch, vibration, pain and other sensations are all part of the touch sense and are all attributed to different receptors in the skin. Touch isn't just a sense used to interact with the world; it also seems to be very important to a human's well-being.
2. **Sight:** Sight, or perceiving things through the eyes, is a complex process. First, light reflects off an object to the eye. The transparent outer layer of the eye called the cornea bends the light that passes through the hole of the pupil. The iris (which is the colored part of the eye) works like the shutter of a camera, retracting to shut out light or opening wider to let in more light.
3. **Hearing:** This sense works via the complex labyrinth that is the human ear. Sound is funneled through the external ear and piped into the external auditory canal. Then, sound waves reach the tympanic membrane, or eardrum. This is a thin sheet of connective tissue that vibrates when sound waves strike it.

The vibrations travel to the middle ear. There, the auditory ossicles — three tiny bones called the malleus (hammer), incus (anvil) and stapes (stirrup) — vibrate. The stapes bone, in turn, pushes a structure called the oval window in and out, sending vibrations to the organ of Corti, according to the National Library of Medicine (NLM). This spiral organ is the receptor organ for hearing. Tiny hair cells in the organ of Corti translate the vibrations into electrical impulses. The impulses then travel to the brain via sensory nerves. People retain their sense of balance because the Eustachian tube, or pharyngotympanic tube, in the middle ear equalizes the air pressure in the middle ear with the air pressure in the atmosphere. The vestibular complex, in the inner ear, is also important for balance, because it contains receptors that regulate a sense of equilibrium. The inner ear is connected to the vestibulocochlear nerve, which carries sound and equilibrium information to the brain**.**

4. **Smell :** Humans may be able to smell over 1 trillion scents, according to researchers. They do this with the olfactory cleft, which is found on the roof of the nasal cavity, next to the "smelling" part of the brain, the olfactory bulb and fossa. Nerve endings in the olfactory cleft transmit smells to the brain, according to the American Rhinologic Society.
5. **Taste:** The gustatory sense is usually broken down into the perception of four different tastes: salty, sweet, sour and bitter. There is also a fifth taste, defined as umami or savory. There may be many other flavors that have not yet been discovered. Also, spicy is not a taste. It is actually a pain signal, according to the National Library of Medicine (NLM). The sense of taste aided in human evolution, according to the NLM, because taste helped people test the food they ate. A bitter or sour taste indicated that a plant might be poisonous or rotten. Something salty or sweet, however, often meant the food was rich in nutrients.

2.2 Pedagogical Module

Pedagogical module represents teaching strategies, (examples, and analogies) and includes methods for encoding reasoning about the feedback. In another words, pedagogical module controls the overall functions of the intelligent tutoring system.

2.3 Student Model

Student module represents students' mastery of the domain and defines how to reason about their understanding. It comprises both stereotypic student knowledge of the domain (usually student skills) and information about the present student

(e.g., time spent on problems, possible misconceptions, correct answers, preferred learning style, and hints requested).

Each student has a profile which contains some information about the student, such as name and student number in addition to the student's major, dates of login. This student model determines the level of the students according to his answers for the questions, if the results >75%, the students can move to a higher level which is more difficult than the previous one, showing the student percentage for each level and the number of questions answered successfully.

2.4 Dialogue Module

Dialogue module represents methods for communicating between students and computers. It includes discussing student reasoning, managing communication, and sketching graphics to illustrate a point, showing or detecting emotion, and explaining how conclusions were reached.

The ITSB contains two interfaces for two users: the teacher and the student. The student can use his/her interfaces through the login screen using the student number showing the student name and student last session on the system. Figure 2 shows the login interface. Figure 3 – Figure 11 shows the interfaces of the intelligent tutoring system.

The teacher interface presents three main parts, the first one, the teacher adds the material and the lessons with the ability to add video and pictures to help the students understand the lessons. The second interface presents the questions and the answers. And the third interface offers some modification on font name, font size and font color, list boxes, combo boxes, labels, buttons, page sheet and rich edit, also adds some users.

3. Literature Review

Recently, Intelligent Tutoring System becomes a very popular and useful in our universities, schools, Factories. There are some of them, such as An Intelligent Tutoring System Authoring Tool designed by Abu Naser teaches how to use java program[6], SQL-Tutor, developed by Mitrovic and Ohlsson, teaches and explains to students the way of writing queries in relational database through several lessons in the basics of writing query[35], ITS for teaching advanced topics in information security[32], development and evaluation of the Oracle Intelligent Tutoring System (OITS)[33], ITS for learning Computer Theory[34], e-learning system[9,12], ADO-Tutor: Intelligent Tutoring System for leaning ADO.NET[19], dance Learning from Bottom-Up Structure (DL-BUS) based on automated lesson generation systems, teaches beginners basic dance movements through analyzing and dividing dance into lessons[36]. PIXIE Design by Sleeman in 1987 is based on Leeds Modeling System (LMS) to examine errors in algebra [37]. MYCIN is expert

system for diagnosing diseases such as cancers, based on MYCIN, Designed GUIDON to display the lessons of the disease and symptoms, showing rules in the knowledge base of the student [38], an agent based ITS for Parameter Passing in Java Programming [30], Java Expression Evaluation[26], Linear Programming [14, 23], an Intelligent Tutoring System for Entity Relationship Modeling [29], an Knowledge-based Intelligent Tutoring System for Teaching Mongo Database [5], Design and Development of an Intelligent Tutoring System for C# Language [15], effectiveness of e-learning [31], computer aided instruction [6], effectiveness of the CPP-Tutor [26], teaching AI searching algorithms [28], teaching database to sophomore students in Gaza [25], and Predicting learners performance using NT and ITS [21], ITS which called CPP-Tutor for helping student to learn C++ Programming Language [27], a comparative study between Animated Intelligent Tutoring Systems (AITS) and Video-based Intelligent Tutoring Systems (VITS) [7], authors in [20] developed a stomach disease Intelligent Tutoring System, authors in [13] presented an Intelligent Tutoring System that mentors diabetics, giving them the ability to develop the necessary capability, in [11] the authors built an Intelligent Tutoring System for Learning Java Objects that will help students to study Java objects by present the area of Java objects and administers automatically generated problems for the students to work out and the system dynamically adopt at run time to the student's individual progress, and ITS teaching grammar English tenses [10].

4. Conclusion

In this paper, we have designed an intelligent tutoring system for teaching science subject (the 5 senses) by using ITSB tool. The system is designed to help students study or learn the material easily and to enhance their education achievement.

In an initial evaluation of the system, the students and teachers were satisfied with it.

In the future we will modify the intelligent tutoring systems to include the rest of the material of the 7th grade science book of the Palestinian Ministry of Higher Education

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