

# Multi Agent Learning Styles Based Intelligent Tutoring System

Ifeanyi Isaiah Achi<sup>1</sup>, Chukwuemeka Odi Agwu<sup>2</sup>

<sup>1</sup>Department of Computer Science, Our Saviour Institute of Science and Technology, Enugu, Enugu State, Nigeria

<sup>2</sup>Department of Computer Science, Ebonyi State University – Abakaliki, Ebonyi State, Nigeria

**Abstract:** *This paper explores a new approach of using the four learning styles to modeling the student in an intelligent tutoring system (ITS), by providing a student model which learns new solutions from the student by considering the four learning styles as the several paths to the student knowledge. This solution will be possible through the multiple-agent software built into this new system that will enable modeling of several possible solution paths when monitoring the student learning process and keeping track of the best path (learning styles) to the student's solution. This capability is an improvement compared to the previous research reported in literature; using the different learning styles as a path to the student knowledge. The student model is extended by providing a learning module, which is capable of recognizing new solution provided by the student. These new solutions will now be included in the expert system knowledge base. Therefore in this paper, the concepts and implementation of the current ITS as well as the different modeling methods used will be explored. We exhaustively discussed the several learning styles, such as Auditory Learners (through hearing), Visual Learners (through seeing), Kinesthetic Learners (through touch or practice) and hybrid (combination of two or more) will be used as paths to students solution or path to students knowledge while modeling the student.*

**Keywords:** Multi Agent System (MAS), Intelligent Tutoring System (ITS), Auditory Learners (AL), Visual Learners (VL), Kinesthetic Learners (KL), hybrid Learners (HL).

## 1. Introduction

This paper examines a typical multi agent learning style intelligent tutoring system that utilizes four (4) learning styles as several paths to the student knowledge through the student model which learns new solutions from the student. Our motivation was borne out of the need to know and understand that the types of learning styles is important for students of any age[3]. It is advantageous for students to understand their type of learning style early on so that homework and learning may become easier and less stressful in the future[4]. This is the essence of this research. Recall that according to Leman at. el, [13] most ITS is composed of at least three modules: expert (or domain) model, a student model, and an instructor (or pedagogical) model. The expert model represents information specific to the subject being taught, the student model portrays the current student understanding or misunderstanding of the subject domain [14] and the instructor module contains the knowledge required of teachers to select meaningful lessons for their students. An intelligent tutoring system is a computer system that aims to provide immediate and customized instruction or feedback to learners, usually without intervention from human teacher[15]. According to sykes, [16] ITS are growing in acceptance and widely deployed with the following reasons: increment in student performance, (ii) a deepened cognitive development, and, (iii) a reduced time for the student to acquire skills and knowledge. Achi and Agwu, [17] in their work opined that the integration of a software agent into ITS would provide a framework that would facilitate learning to meet variety of learner needs. Software agent could be described as an intelligent code which has a specific plan of action specified in a limited domain and is capable of a behavioral pattern which allows it to change at the right moment its own interaction with the

world depending on the stimuli from the environment [18]. Agents when deployed in systems intelligently and autonomously pursue their actions and sub goals to corporate, and coordinate to respond flexibly to dynamic and unpredictable situations. Because of the characteristics which software agent exhibits, they are widely deployed in various application domain [19]. Multi-Agents system which is one of the problem solving techniques in AI, especially in solving complex problems was considered in this research. Multi-Agent intelligent tutoring system could only be realized with a better understanding of how this Artificial Intelligence (AI) techniques works and how it could be used in accomplishing this new proposed system. The computer world has been striving to emulate the intelligence of the human brain for many years now. These attempts at mimicking the reasoning ability of the brain are frequently described as artificial intelligence (AI). One of the most promising, yet most elusive, goals of AI is to create an intelligent tutoring system (ITS) with the human teacher's ability to infer a pupil's or students level of understanding which is our focus on this paper. To build a system that could infer a student's level of understanding by modeling the student solution, several paths, learning styles will be considered and the best path will be tracked and stored and used for the student when next to ensure reduced learning curve and ensure the student gets what he is being taught. Many ITS researchers in the past, have not really emphasized on this inference module while developing an ITS. They were only concerned with the teaching and not modeling the student under tutor in terms of learning styles to know their best learning styles to students understanding of a subject matter and thereby knowing their best solution path. This is the weakness which other authors have not considered which this paper addresses. When this new system is implemented successfully, we will now be able to find out the best learning styles to student's solution and thereby achieving

a reduced learning curve by students.

An ITS is desirable because schools system could get better when attention is paid to individual students with inexpensive computer programs. At present, all students are required to do all problems because teachers cannot provide individualized attention. Since not all students are the same, not all students require the same amount of reinforcement in order to grasp a particular topic. Ideally, with an ITS, the student can progress at a pace exactly corresponding to his understanding. Concepts the student does not understand well will be repeated, while others may be presented only once, thus avoiding the workbook mentality of standard classrooms. As stated by Kurt Vanlehn, I want an ITS that "understands the student and responds to the student's special needs." [1] ITS research is also important to the graduate, tertiary students, Air Force, military and to any other field in general where training is required. Training personnel is an expensive requirement. As equipment and weapons become more technologically complex, training requirements for maintenance and operations increase. Potentially, automated training and education could reduce the number of hours spent training and retraining troops, while also freeing domain experts from training requirements for actual mission work. A robust ITS could serve the Air Force well: it would not only allow automated training of troops, but could train them at the optimal rate for each individual. Kurt Vanlehn [1] found a four-to-one advantage for tutored students over classroom taught students, when measuring time required to reach proficiency in programming. If ITSs successfully attain a similar success rate, all organizations requiring extensive training of employees stand to benefit.

## 2. Learning Styles

There are three main types of learning styles: auditory, visual, and kinesthetic [5]. Most people learn best through a combination of the three types of learning styles, but everybody is different [6].

### • Auditory Learners: Through Hearing

Sound being one of the sensitive organs of the body [7] could also be used in teaching students. Auditory learners would rather listen to things being explained than read about them. Reciting information out loud and having music in the background may be a common study method. Other noises may become a distraction resulting in a need for a relatively quiet place. This is because some students are more sensitive to sound [8].

### • Visual Learners: Through Seeing

Some people are more sensitive to their sight and as such could base their learning on what they could see[9]. Visual learners learn best by looking at graphics, watching a demonstration, or reading. For them, it's easy to look at charts and graphs, but they may have difficulty focusing while listening to an explanation.

### • Kinesthetic Learners: Through Touch

Some people are practically minded [10]. Kinesthetic learners process information best through a "hands-on" experience. Actually doing an activity can be the easiest way for them to learn. Sitting still while studying may be difficult, but writing things down makes it easier to understand.

### • Hybrid Learners: Combination

Most people has the complex nature and as such could cope with a combination of learning styles[11] This learning style is a combination of one or two or even three of the other learning styles. Although most people use a combination of the three learning styles, they usually have a clear preference for one.

## 3. The Multi Agent Learner Based System

This system still maintains the architecture of the normal ITS-the student model, tutorial model, interface model and the expert domain model. The only difference is that within the tutorial model, which is where the student interacts with knowledge or expert domain through the human interface or the interface model is expanded to be able to accommodate the four learning paths. The diagram below shows a typical learning path based ITS. In the fig below, the path1-path N signifies the different learning styles where N mean any number but in this case N is already defines as four(4);which is the four learning styles. The system tries to use the different learning styles to teach the student being model and as well find out the best learning style that is more appropriate for the student learning so as to use it any time the student needs to learn. This will be a web based system that will enable each student to be profiles and their record kept within the system for future use.

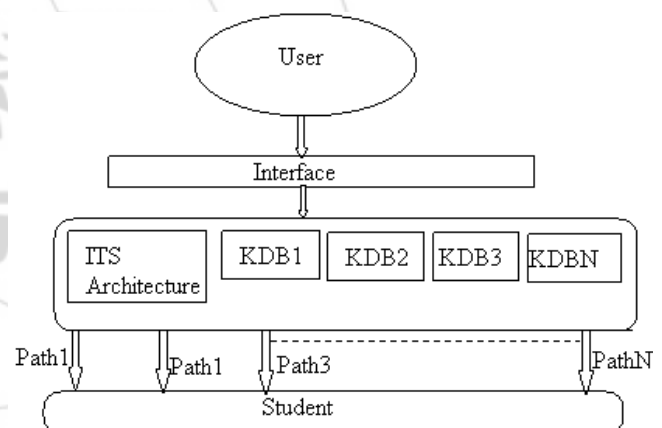


Figure: Multi Agent Student Model System  
Adapted from Achi (2015)

## 4. Conclusion

This paper is focused on building a multi agent learning style based intelligent tutoring system by providing a student model which learns new solutions from the student by considering the four learning styles as several paths to student knowledge. Our motivation was borne out of the need to address students learning ability which is becoming paramount in our educational sector of the economy and other areas where teaching and training is necessary for the growth of the organization. With the recent developmental trends in technology, every field will need one training or the other to be able to master the equipment in use or the software in use. As a result, the ability to learn and understand is becoming the central goal of most organizations so as to aid teaching and modeling of the students to know the best learning style the student requires at every point in time to reduce the student's learning curve.

Hence, the need to develop a good software based teaching program to meet the needs of learners has become the other of the day such as the one that will teach and model the students to know the best learning style the student requires at every point in time. Students are different and they have different learning styles they can adapt to [12]. This system if deployed would help to find out the best learning path each student can adapt to while learning.

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