

# A Generic Framework for Intelligent Tutor using Ontology

A.Jaya<sup>1</sup>

<sup>1</sup>Professor, Department of Computer Applications, B.S.Abdur Rahman University, Chennai, India

**Abstract:** Attention deficit hyperactivity disorder (ADHD) is a common behavioral disorder that affects about 10% of school-age children and also it hurt a child's ability to function socially, academically, and at home. Assessing, diagnosing and recommending their need for ADHD/LD children is easy for human beings, whereas it is difficult for the system to analyze. This intelligent tutor helps to identify the level of learners by assessing their skills and also recommends the mode and area of study. This research article explores how to perform intelligent reasoning on learners using ontology. Ontology is a formal explicit shared conceptualization that contains domain knowledge from which one can detect valid concepts. This research work focuses on generic framework for analyzing the knowledge level of learning disability children based on their skills and knowledge and also it suggests the mode of teaching to educate them based on their need

**Keywords:** Reasoning, Ontology, Learning.

## 1. Introduction

It is estimated that approximately 16% boys and 8% girls in the age group of 5-17 years suffer from Attention Deficit Hyperactivity Disorder (ADHD) or Learning disability (LD). Boys are three times more likely to have LD diagnosed than girls, either with or without ADHD. Learning disabilities affect approximately 15 percent of the children population worldwide. As of now, almost three million school age students need special education services because of learning disabilities.

Children with learning disability cannot try hard, pay close attention or improve motivation on their own; they need help to learn how to do things. These students or learners are classified as **slow learners**. Awareness of above such as LD & ADHD is started spreading to Indian parents in recent times. Hence in some private schools in India are able to identify children with learning disability and their problems are resolved to some extent by conducting special training classes. But many students especially in rural areas and economically weaker sections of India are not identified their learning disabilities. Such children with LD or ADHD are from different families and many of them are not afford to arrange special training to make up their deficiency. These children are neglected in the society, and they will lag in academic studies and poor quality in reading skills, which will affect badly in their carrier life. However, these children could meet the level of intelligence in 3 to 4 years with proper training. Moreover, the special coach or trainer or teacher could not be with slow learners all the time. Hence it is necessary that the tutor should play a role of intelligent teacher and cater the need of the learners.

This research work aims to develop an intelligent tutor system using ontology and data mining techniques. Development of an ontology helps to provide the semantic relationships among the concepts. Decision tree helps for reasoning to seek out the needy requirement of the learners. Hence, this tool performs intelligent reasoning to assess the knowledge about the learners and recommends the mode and portion that need to be improved with the help of tutorial aids.

Section 2 focuses on the related works on semantic reasoning. Section 3 focuses on framework for intelligent tutor and its components. Section 4 and 5 provides the results obtained and the conclusion respectively.

## 2. Related Works

This section discusses the learning process and their related supporting articles. Thongchai Kaewkiriya et al. (2011) described the learning process in which the school students will be allowed to access the system based on the background check of the student credentials like: roll number, school name, standard etc. The student first requests the system for allocating a teacher for a particular subject training and based on the subject name, the system will redirect the student with the images of teachers who train the particular subject and accordingly the students can select the teacher's picture and an email will be sent to the teacher regarding the request made by the student and the teacher will train the students once they accept the request. In this system there is no use of content management system or no content is stored in the system but in contrast all the communication is made through a common email system linked in the application.

Julie M. Little-Wiles et al. (2010) have described about the research on analyzing the usage of E-learning in the web, providing the best learning environment, providing the best tools to the students, and also analyzing the best critical elements necessary for student to take up a learning management system.

Liyong Wan , et al. (2005) have described different unique features and capabilities of a learning content management system that is used to create, store and deliver contents in the form of learning objects. Dan Tian (2005) have described the progress based online assessment system for the first year networking classes in the field of engineering. It used a concept of Network Assessment Management System which provides the way to organize the networking course contents and assess the student using the Learning Advancement Management System.

Sergio Rapuano et al. (2005) have described a new approach for distance learning system for teaching electric and electronic measurement. The theoretical parts of the courses are provided by a standard Learning management system (LMS), enabling the account management; the security protection; the collaborative learning; the student activity tracking, and the feedback collection.

Jaya et al (2009) proposed Automatic Story Generation (ASG) tool to generate a variety of stories automatically by the system which helps to motivate the kids to concentrate on the flow of story by allowing them to create variety of themes for narrating the new stories. ASG comprises of three components such as theme conception, language generation and semantic reasoning .Theme conception component incorporates the story grammar which helps to conceive a theme by organizing a related order of events for constructing new stories.

The intelligent reasoner utilizes ontology and classifying techniques to reason the skills of learners and it recommends the required mode of learning for them.

## 3. Framework for Intelligent Tutor

Figure 1 describes the framework of the tutor and its components. They are User interface, Learning Strategies, Assessment Strategies, Intelligent reasoner and Repository. The tutor initiates the learners to select their choice of subjects that they like to familiarize. The mode of study will also be given as choice by the users. The next activity is practicing section based on concepts learnt and assessment sessions. If the learner is classified average performer or non-performer level, then the tutor takes back them to learning phase with different modes of study. It records the learners profile and their level of learning. The tutor acts as intelligent teacher to provide appreciation points, planners to organize activities, self evaluation, etc. These kinds of presentations attract the learners, increase their concentration as well.

### 3.1. User Interface:

User Interface takes vital role in interacting with slow learners in their level of understanding. The Figure 2 shows the interactive page of the learners. The user interface screens which communicate effectively and efficiently through graphic design to the user.

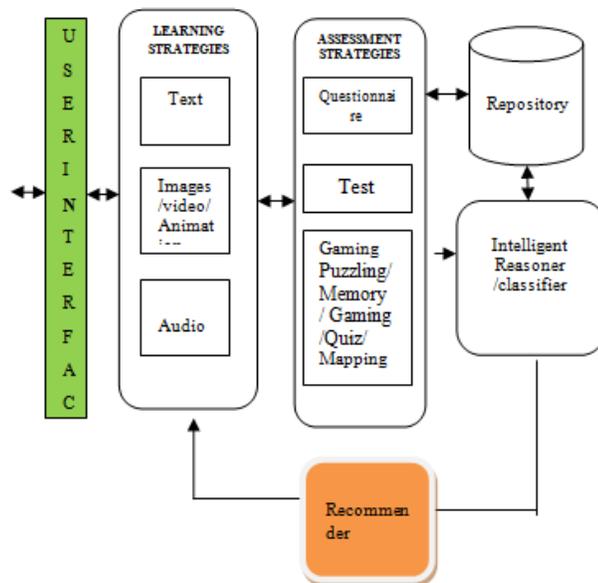


Fig. 1: Framework for intelligent tutor system for LD and ADHD

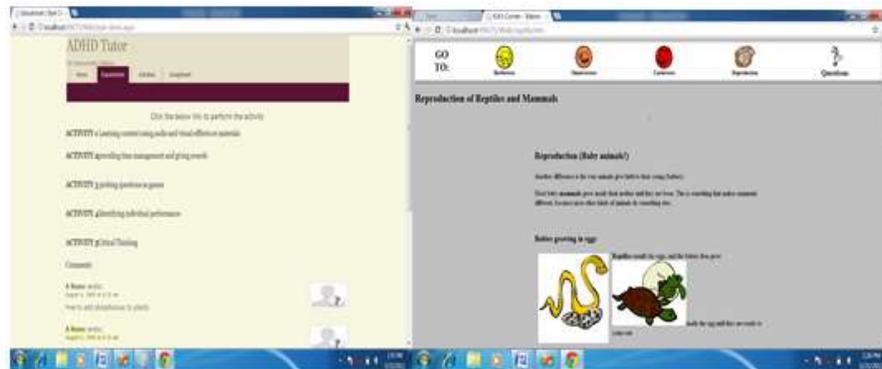


Fig. 2: User Interface screen for Learners

### 3.2. Learning Strategies

This tutor provides different Learning strategies for different types of learners such as

- Visual Learner – use of visual aids
- Auditory Learner – use of Audio files
- Kinesthetic Learner – use of physical activity

Learning or instructional strategies determine the approach for achieving the learning objectives that include pre-instructional activities, information presentation, learner activities, testing and follow-through. The strategies are usually tied to the need and interest of the students to enhance learning. This tutor adheres the Bloom's taxonomy in which the learning starts with remembering the tasks, understanding the knowledge, applying it in different situations and improving the analyzing skills. This tutor provides concepts about the technical subjects and scientific experiments in the form of text, images, audio and video to make the slow learners to understand the concepts in an interactive manner.

### 3.3. Repository using ontology

Ontology defines a common vocabulary for researchers who need to share information in a domain. Tutor ontology possesses the generic knowledge about scientific experimental design [Soldatova, Larisa ,2006] audio tags, video tags, question and answers. The learner comprehends the scientific experiments during the assessment phase. The answers given by the learners are fed to the reasoner. It evaluates the conceptual understanding of scientific experiments by the learners. Also, it possesses the knowledge about the soft skills

question and answers. This helps the tutor to assess the knowledge and a skill of learners. Ontology supports the tutor in two ways

- (i) It possesses the domain information.
- (ii) It supports the tutor for evaluating the test performances

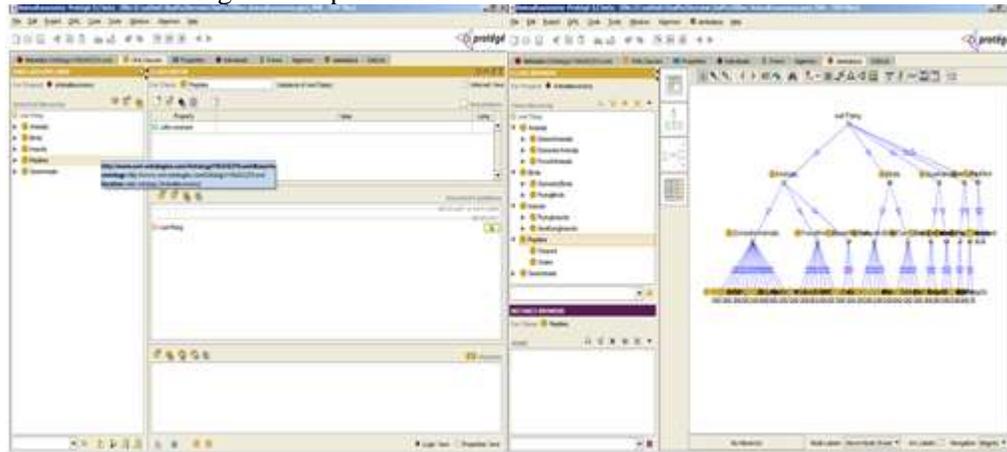


Fig. 3: Protégé tool: Ontology visualization

### 3.4. Assessment Strategies

The formal assessment may be a motivating factor for some students. The assessment can help the learners to know upon their own learning and progress. This inference will help to improve their attainment and achievement of slow learners. The tutor uses the list of assessment techniques such as Quiz, Presentation, Project work, Concept mapping, Comprehension and Puzzle solving. Based on their answers and scores they will be classified as performers and non performers.

### 3.5. Intelligent Reasoner and Trainer

The reasoner and classifier are key components to perform the reasoning based on student information from their test performances. Classifier analyzing the basic information of learners and classify them using decision trees.

#### 3.5.1. Reasoner

The reasoner requires the following factors such as test mark, soft skill rating, analysis rating and the time taken to complete the assessment are considered for classifying the learners. The algorithm for reasoner is given below:

*Semantic\_Reason (T\_M, Soft\_R, An\_R, TTC)*

```

{
  Step 1: Retrieve the set of facts from the assessment pool which is parsed as the input.
  Step 2: Segregate based on the marks obtained.
  Step 3: Repeat the steps (a) to (c) until all the facts have been considered for an entity.
  {
    (a) Compute the student marks and rank students based on the assessment T_M.
    (b) Apply the factors considering Soft_R, An_R, and TTC. Compute the skills set of the learners
    (c) Apply the rules for inference to classify the learners } // end of loop
  Step 4: Reasoner suggests the mode of learning method for the slow learners.
} // end of algorithm

```

#### 3.5.2. Classifier

The Figure -4 shows the various test performed and their level of knowledge is classified as path. The Traversal path of the graph and their respective clusters are given in Table1.

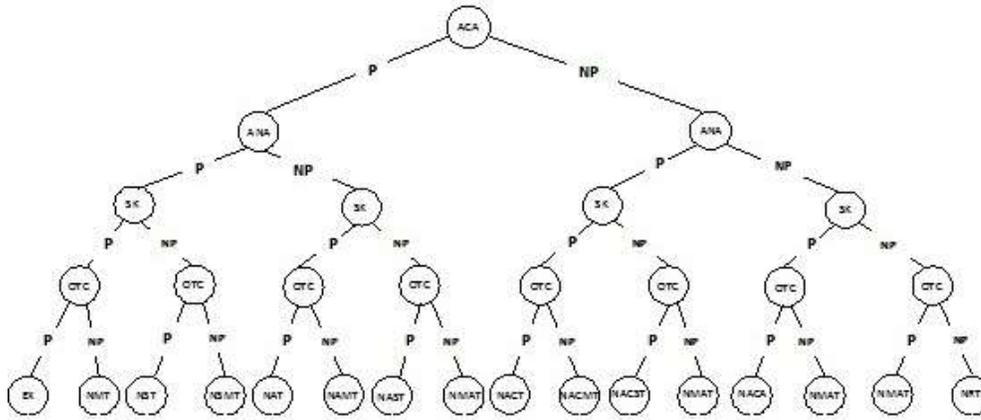


Fig. 4 : Decision tree for classification of Learners

TABLE I: Test Performance path and their classifier

SI NO	ACAdemic	ANA	SK	OTC	Classifier Output
1.	P	P	P	P	C1
2.	P	P	P	NP	C1
3.	P	P	NP	P	C1
4.	P	P	NP	NP	C1
5.	P	NP	P	P	C2
6.	P	NP	P	NP	C2
7.	P	NP	NP	P	C2
8.	P	NP	NP	NP	C2
9.	NP	P	P	P	C3
10.	NP	P	P	NP	C3
11.	NP	P	NP	P	C3
12.	NP	P	NP	NP	C3
13.	NP	NP	P	P	C4
14.	NP	NP	P	NP	C4
15.	NP	NP	NP	P	C4
16.	NP	NP	NP	NP	C4

The c1 classified as Fast learner whereas they require normal study; anyone area like analysis skills, soft skills or completing on time need to be retrained. The c2 recognized as average learners whereas they need little more comprehensive training. The c3 and c4 are not academically strong. They need to undergo training again and again by various methods like audio and visual aids in order to improve their level.

#### 4. Experimental results

The tutor was tested with 40 students of Diksha, Adhd training center and yielded the results and proper diagnosis. The table 2 shows the results obtained and Figure 5 represents the graphical representation of learner classification.

TABLE II: Results of Learners

S..NO	No students	classifier	Recommend
1.	7	C1	revisit
2.	13	C2	Study the material and solve puzzle
3.	17	C3	Use Audio, animation videos and solve puzzle
4.	3	C4	Need severe training and learn through videos

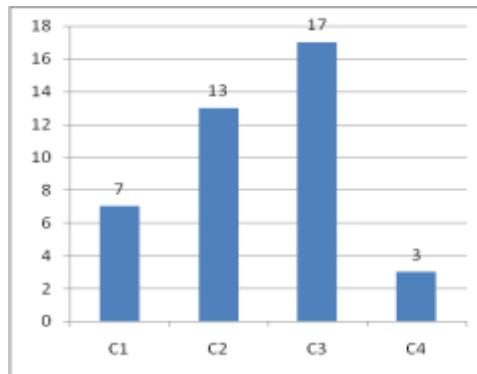


Fig. 5: Classification of Learners

Out of 40 students' 25 students diagnosed and recommended correctly with 62.5% of accuracy whereas the reason for failures is the candidate answer the question by chance or by mistake they have pressed or lots of deviation while performing the test also. Hence it is necessary that psychological analysis of learners is required to improve the reasoner phase in the tutor.

## 5. Conclusion

The Learning and assessment strategies, allows the student to learn the resources uploaded by the Experts and allow them to take up test on the topic they learnt. The reasoner component allows the student to view their performance and categorization of Knowledge level based on the test result. The recommendations given to the students are more appropriate and suitable. But the system is not able to focus on the psychological behavior of the learners and also it fails to focus on the kinesthetic behavior of learner. Hence the tutor can be improved in many ways such as subject reasoning, tutor should support for physically challenged persons also.

## 6. Acknowledgement

I really thank Diksha, Adhd training center, T.Nagar, Chennai, India for support in learning methodologies and to carry out the tests among their students. Also my sincere gratitude to Our B.S. Abdur Rahman University for carrying out the project.

## 7. References

- [1] Thongchai Kaewkiriya, Nattavee Utakrit, Hiroshi Tsuji "Experimental Evaluation of Distributed e-Learning Management System", 2011 IEEE.  
<http://dx.doi.org/10.1109/TENCON.2011.6129301>
- [2] Julie M. Little-Wiles, Stephen P. Hundley, and Adrie Koehler "Work in Progress - Maximizing Student Engagement in a Learning Management System", 40th ASEE/IEEE Frontiers in Education Conference 2010.
- [3] Liyong Wan, Chengling Zhao, Qingtang Liu, Junyi Sun "Work in Progress-An Evaluation Model for Learning Content Management Systems: from a Perspective of Knowledge Management", 35th ASEE/IEEE Frontiers in Education Conference, 2005.
- [4] Dan Tian, "A Progress-Based Online Assessment System For First-Year Networking Classes", 35th ASEE/IEEE Frontiers in Education Conference, 2005.
- [5] Sergio Rapuano, Francesco Zoino, "A Learning Management System Including Laboratory Experiments on Measurement Instrumentation", 2005 IEEE.  
<http://dx.doi.org/10.1109/IMTC.2005.1604342>
- [6] A. Jaya and G.V.Uma, "Role of Ontology in Automatic Construction of Stories for Kids" IEEE International Conference on Intelligent Agent and Multi-Agent Systems 2009, organized by Vinayaka Mission's University (VMU), published in IEEE XPLORE, 978-1-4244-4710-7, Jul 22- 24, 2009
- [7] Soldatova, Larisa N, and Ross D King. "An Ontology of Scientific Experiments." Journal of the Royal Society Interface 3.11 (2006): 795–803. PMC.  
<http://dx.doi.org/10.1098/rsif.2006.0134>