A Method of Constraint-Based Tutor for Object-Oriented Analysis and Design Curriculum

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Abstract: *To overcome the problems existing in the methodology of Object Oriented Analysis and Design (OOAD) teaching, this paper points out a model of an Intelligent Tutoring System (ITS). ITS, has reformed education by paying individual attention towards each student. Constraint-based tutor model is an advanced and successful approach towards adaptive learning environments. It overcomes many problems that other modelling technique suffers from. The aim of this paper is to simplify OOAD teaching methodology and to reduce the complexity for enhancing the level of teaching and to provide better understanding of students.*

Keywords: *Intelligent Tutoring System (ITS), Constraint-based Modelling, Object Oriented Analysis and Design (OOAD).*

1. Introduction

Offering Web-Based environment for learning is rapidly increasingly important in present modern computing environment as of each and every day amount internet user's increases rapidly and resources for effective learning are limited. The concept of using computers in the education field is not a new and various E-learning systems exist but the problem is they are very simple and restricted interaction with the user. In-order to make the learning to be effective, each student must be active and each student must get the opportunities to practice important topics so that they can enhance the level of understanding by doing it practically they can understand clearly . Moreover we all know that one-on-one human teaching is very effective and it has high impact when compared to usual classroom teaching, provides an increase standard in learning performance. The aim of paper to make use of Intelligent Tutoring System (ITS) is to build computer based tutors for better understanding of OOAD curriculum and increase effectiveness of learning individually with a human tutor. ITS provides support to each individual student, an isolated robustness that has been in-built to model variety of knowledge needed for instruction: domain knowledge, student model, models of pedagogy and communication knowledge. Since the establishment of ITS many approaches for developing them has been proposed unfortunately most of them stayed in research labs.

In the last decade new type of ITS, referred to as Constraint-based Tutors has transpire. A unique character of Constraint-based Tutors is knowledge must be represented in the form of constraints, which tells what commitment to be done, instead of dealing with problem-solving procedure. Domain knowledge is used for settle abstract feature of correct solutions, instead of performing the task in domain .Constraints reinforce evaluation and judgment and used for representing both domain and student knowledge.

2. Objective

ITS, has brought a major difference in learning process. The main objective of this paper is to survey all the available ITS model and to find proper, effective model for enhancing the learning process of Object-Oriented Analysis and Design Curriculum among students. Since this Object-Oriented Analysis and Design Curriculum is fully based on software engineering principles so that many students feel very hard to learn this Object-Oriented Analysis and Design however its core concept of all the software that we are using nowadays in this computing era thereby without Object-Oriented Analysis and Design we can tend to say there is no software so in-order to make learning process easy. We have made a survey on ITS models for Object-Oriented Analysis and Design Curriculum.

3. Literature Review

[1] Jayalaxmi "Active Learning Methods for Teaching OOAD Course" says that in software engineering Object Oriented Analysis and Design models a system as a group of interacting objects. It is one of the designing courses that the students are learning and using throughout the SDLC. Since OOAD has involved many theoretical concepts so that tutor may face difficulty while teaching. Students need to understand the concept properly and map objects to real world. Hence it's better to use open source tools like Pace Star, E-draw, UMLet, AgroUML, Astah. These novel methods improved analysis, design, implementation and learning ability of OOAD concepts.

[2] Huiqiang Lin "A Method of Elicitation Teaching for Object Oriented Analysis and Design

Curriculum" explores an problems existing in object-oriented analysis and design teaching, the application necessity of the society and status of the present IT intellectuals and points out method of elicitation teaching for Object Oriented Analysis and Design curriculum and shows the result among students has improved studying enthusiasm, improve effect of teaching, motivate the student.

[3] Michal Smialek "Teaching OOAD with active lectures and brainstorms" describes as three basic elements of teaching object orientation. For each of elements active learning techniques are described. This technique is used to show the "Big Picture" and "Clear traces". Another Set of techniques is used to present various design methods. These includes use case sessions, CRC sessions, and role-play sessions. For each of the techniques various ideas that would allow enhancing their pedagogical impact are presented.

[4] Nael Barakat "A Model For On-Line Education of ABET-required professional Aspects of Engineering" Describes as On-line model education to engineering students which was designed to target a combination of challenges with a built-in continuous learning mechanism. However issues related to students participation, perception, maturity and context of application as well as issues related to on-line education suitability for the topic were revealed. Understanding these finding helped significantly in improving the plan for the next offering of this experience.

[5] Daniela Rosc "An Active/Collaborative Approach in Teaching Requirements Engineering" says that Requirements Engineering (RE) course is a component in Master in Software Engineering . RE course introduces process, methods, and tool and corresponding software quality issues. To reinforce the concepts learned, students actively participate in learning we make use of eliciting requirements, collaboratively improve the quality of their standard requirements.

4.Research Gap

From the Literature Review we conclude that various e-learning method and Intelligent Tutoring System (ITS) models are available however they lack in understanding the basis of the system and less interactive with the students hence from survey we are suggesting the new Constraint-based tutor model for effective teaching. A unique character of Constraint-based Tutors is knowledge must be represented in the form of constraints, which tells what commitment to be done, instead of dealing with problem-solving

procedure. Domain knowledge is used for settle abstract feature of correct solutions, instead of performing the task in domain .Constraints reinforce evaluation and judgment and used for representing both domain and student knowledge.

5. Research Models

5.1 Active Learning

Active learning concentrates on the teaching function. It helps the teacher select objectives at the correct level of difficulty to meet the student's needs. [8][9] The teacher encourages the students to be responsible for their own learning. Active learning brings the students into the organization, thinking, and problem solving process of the discipline. [10] Active learning also gives the teacher time to perform the helping teacher functions of coach, listener, and advocate.

Example: class discussion, small group discussion, debate etc.

5.2 Collaborative Learning

Collaborative Learning is the collection of two or more resources to learn. Unlike the Individual Resources, it focuses to solve the problem in collaborative manner. [7][11][12] Collaborative Learning happens when students work together or are made to work together in pairs or groups to complete a specific task or work together.

Examples: workshops, team projects, group field-work, study groups, seminars etc.

5.3 Active lectures and brainstorms

Brainstorming is an active learning strategy in which students are asked to recall what they know about a subject by generating terms and ideas related to it. In brainstorming, however, students are encouraged to stretch what they know by forming creative connections between prior knowledge and new possibilities.

5.4 Elicitation Teaching

Eliciting is a technique, in which teacher knows the information about what the students know and don't know in terms of knowledge or subject. [13][14] This means that the teacher becomes more capable and doesn't waste time rehashing the students existing knowledge. Eliciting creates a learner-centered environment and is very thought-provoking for the students.

5.5 Constraint-based tutor model (CBT)

[6]Constraint-based tutor model (CBT) is an abstract idea to a methodology proven via development of effective tutoring systems and dynamic [15][16] ITS authoring tools. CBT is now developed and successful method for learning environment. Many experimental results show that this approach is effective in student learning environment.
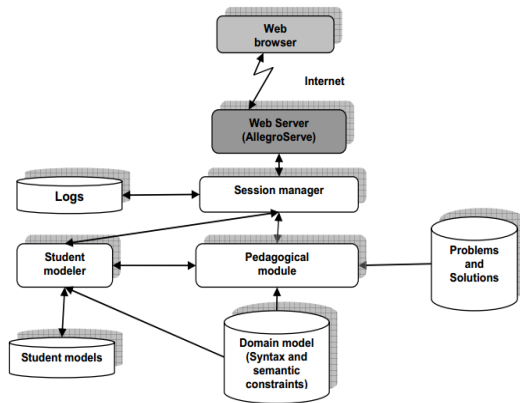

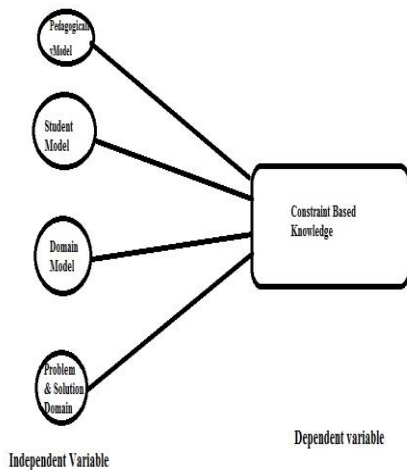
Fig-1 architecture of system CBT

Fig-2 parameter of constraint based tutor

5.5.1 Knowledge as Constraint

fig1 status the actual architecture of CBT. Constraint-based modeling makes use of abstract to avoid student's misconceptions. Constraints represent only proper information in terms of pedagogically significant states. Each constraint consist set of solution according to each specific domain principle. If any solution that violates a given constraint then it can be solved by three constraint conditions relevance condition, a satisfaction condition and feedback message. The relevance condition deals in terms of problem and solution whenever this constraint is satisfies. Fig 2 status the parameter required for CBT. [17]The satisfaction condition deals with more no of tests in-order to evaluate the correctness of solution. Feedback message deals with point outs why it is wrong and helps to correct the mistakes. Constraints represent the domain knowledge in-terms of specifying advantages of proper solutions in the domain.

5.5.2 Pedagogically Model

Pedagogically Model deals with the instruction provided and any errors committed during student's action, ITS will provide the feedback about the violated constraints. It tells the student what domain model has been violated, how it has been violated by student solution and reiterate the correct domain model. Pedagogically model can be adapted to a particular student.

5.5.3 Student Model

Student model deals with problem selection, it makes ITS to select the problem according to problem domain which consist of three level's. [18] First level deals with easy set of problem, second level deals with moderate level of problems, third level deals with hard set of problems so that this model helps students get trained and master.[19] CBT supports the process by providing Information about the mastery and novelty of concepts and exercises.

6. Data Analysis and Result

In-order to conduct the data analysis (survey) initially we have framed few set of questions and those questionaries' are based on the factors of ITS model's. These questionnaires are responded by various students/professor in Google forms and from the data analysis it has been clearly understood the students/professor are expecting CBT model with comparing with other models since it enables the short and crispy abstract form of solution's which enables the easier in terms of learner and tutor. From the analysis it is also found that many numbers of students doesn't like to follow up the usual problem-solving technique and they prefer knowledge in the form of constraints, CBT learning technique has greater welcome among students, CBT feedback and suggestion enhances the performance of every student. Hence from data analysis it has been clearly proved that CBT can enhance the students' performance.

7. Findings and Discussion

S N o	Questionnaires	Mean $\overline{X} = \dfrac{\Sigma X}{N}$	SD $\sigma = \sqrt{\dfrac{1}{N}\sum_{i=1}^{N}(x_i - \mu)}$
1	Knowledge be represented in the form of constraint	41.4	46.32818
2	Student's Performance can be increased from Constraint Based Learning, or not	40.2	46.3875
3	Learning Methodology is changed by using the Constraint based Learning	42.4	44.21877
4	Is suggestion/guess provided by the CBT is sufficient when students violates the constraint	43.4	43.76985
5	learning techniques (deep and surface and Strategic Approach) helps students in learning process	41.4	45.50065
6	Is the abstract provided by CBT as a solution is useful to students or not?	47.4	54.21531

From the above questionnaire conducted a survey among various students of vit university using goggle form all the data has collected finally around 230 sample data has been collected based on it we can suggest that constraint-based model in the teaching field is best model in the teaching techniques in OOAD. In this survey we asked the people to vote for the following options i.e., Error Ridden, Ridden, Vague or Nothing, Partially Correct, Completely Correct for the above questionnaire. The constraint based learning will helps to the students, to improve the education system. That is directly supports the performance of the students knowledge. Constraint based learning will helps to change the learning methodology of students. The Constraint based tutors, provides the suggestions to students if any violates the rules and restriction. The CBT provides in the abstract format solutions which helps in students to solve their queries. So I recommended to proposed best suits in students and teachers. Should adopt new techniques based on the students response and away of understanding things in teachings.

8. Comparison Report on ITS Models

Table: 1-Advantages and Dis-advantages of Various ITS Models

Model	Advantages	Disadvantages
Active Learning	Increase critical thinking skills in students. Enables students to show initiative. Incorporates more student input and ideas Easier to assess student learning. Meets the needs	Difficult to organize active learning experiences. Requires more time Students may be stressed because of the necessity to adapt to new ways of learning.

	of students with varying learning styles	
Collaborative Learning	students working together	Dominate the group
	earning tasks that are designed for group work	Quiet people may not feel comfortable
	emphasis on interdependence	people just don't get along
	members work together on a set of problems	concept may not be understood
Elicitation Teaching	keeps the students alert helps to realize if the students are listening and understanding or not helps you find out what they already know helps students learn how to guess	Eliciting can get boring/ repetitive
		Eliciting can seem childish
	It can show them how to work things out for themselves	
Constraint-Based Tutor	Knowledge is represented as constraint	Domains it might be impossible to identify properties of problem states
	Divide and conquer technique	
	There is no need to create a bug library	Constraints might not provide the correct type of abstraction
	Ignores the student's problem-solving strategy.	

9. Conclusion

Based comparison and survey reports we suggest among all the models available in ITS,CBT is a very effective modeling approach that provides

good foundations for successful instruction. Constraint-based Tutors has many advantages when comparing with other modeling techniques. CBT doesn't need to maintain libraries (common error) committed by students, which are difficult and expensive to collect and maintain. CBT is robust and doesn't modelled for problem-solving procedures hence it can easily handle mixed strategies of problem solving. This systems is easy to use thereby reduce the working memory load by specifying domain-specific information, solution structure. CBT represent not only domain-level knowledge but also it can include Meta cognitive knowledge. Many online tools are available in order to construct the CBT so that other tutor will able to develop their own constraint based tutor and deploy effective learning environment.

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