IMPLEMENTING UML TECHNIQUES FOR EFFECTIVELY TEACHING INTERNALS OF UNIX OPERATING SYSTEM USING SENSORY STIMULATION THEORY

ARATI SAMEER NIMGAONKAR

Department of Computer Science, Fergusson College, Pune
E-mail: arati.nimgaonkar@fergusson.edu

Abstract - Many computer science educators have no formal training in education. Their work simply gets grounded in the technology. For any teacher or student, it is very hard to find out the sources of difficulty in learning particular concept. According to the Sensory Stimulation Theory proposed by Laird (1985), effective learning occurs when the senses are stimulated and by stimulating the visual sense especially, learning can be enhanced. Unified Modeling Language (UML) is a language proposed for visualizing the system. There are several diagrams with which the static, behavioral and the architectural nature of the system can be graphically designed. UNIX is a vast operating system and is a core part of computer science academic curriculum. We are presenting UML as a technique to teach and learn the complex features of UNIX operating system.

I. INTRODUCTION

There are two methods of explaining the path to a person who is in the search of his it. We can either tell the route to the person verbally or we can draw a road map for the person to understand the route clearly. This map creates a visual impact on the person and can understand it effectively. This is nothing but the sensory stimulation theory proposed by Laird (1985).

Taking this theory into consideration UML (Unified Modeling Language) can be used as a tool to explain the difficult concepts and algorithms in UNIX Operating System.

The objectives of this research work is,
1) To carry out the survey of students learning UNIX operating system to find out the difficult topics according to them.
2) To study the different ways of teaching concepts related to UNIX operating system by which teaching become more effective.
3) To study the Sensory Stimulation theory.
4) Create an instructional material for UNIX operating system.
5) To study the Unified Modeling Language (UML).
6) Redesign an instructional material for UNIX operating system using UML by applying sensory stimulation theory.

II. PROBLEM STATEMENT

On the basis of Sensory Stimulation Theory, applying Unified Modeling Language technique to develop an interactive instructional material for teaching UNIX operating system effectively and test the hypothesis on the collected data.

III. Literature Review

3.1 UNIX Operating System

Every computer requires an operating system (O.S.). An operating system is the interface between a bare machine and a user. According to the use and the purpose, different computer operating systems are available. One of them is UNIX. In 1969, UNIX was developed by Ken Thompson and his team (Ritchie, 1979) in C language.

UNIX has many advantages over all the other operating systems so it is accepted and widely used. Also many of the educational institutes and universities have included UNIX operating system as a base for their computer study. It is the very important part of the syllabus of the plenty of educational courses which are accepted by the different Universities. Not only, using the UNIX, but also studying the internal working of the UNIX is the part of the syllabus. It is very vast subject. Many topics in this subject are straightforward but according to the student's point of view these are tedious and complex. Students face many problems during studying this subject. Every concept in the UNIX is based on the previous concept. So if one of the lectures is missed by the student, then understanding the next becomes difficult. Also it contains numbers of algorithms to explain. Learning these algorithms is very hard job.

Not only for students but also for teachers, to teach this subject is a very challenging job. Since every time teacher has to write these big algorithms it becomes time consuming and a boring job. To reduce this writing work, some of the teachers are now using OHP or develop a PowerPoint presentation for the same. In this teaching method, instead of writing long algorithms on the black board, it is written on the transparencies. Of course this teaching approach

reduces the teacher's work but according to the students, scenario remains the same.

So there is a need to find out the effective way to teach the UNIX operating system which will make subject interesting as well as easily understandable to the student.

3.2 Sensory Stimulation Theory

Sensory stimulation theory has as its basic principle, that effective learning occurs when the senses are stimulated (Laird, 1985). Laird quotes research which found that the majority of knowledge held by adults (75%) is learned through seeing. Hearing is the next most effective (about 13%) and the other senses that is, touch, smell and taste account for 12% of what we know.

By stimulating the senses, especially the visual sense, learning can be enhanced. However, this theory says that if multi-senses are stimulated, greater learning takes place. Stimulation through the senses is achieved through a greater variety of colors, volume levels, strong statements, facts presented visually, use of a variety of techniques and media.

3.3 Unified Modelling Language

A model is a simplification of reality. It represents a blueprint of the system under construction. No single model is sufficient to understand the different viewpoints for a system. Precise model facilitates the effective communication.

Grady Booch, Ivar Jacobson and James Rumbaugh developed UML i.e. Unified Modeling Language in the mid 90's

Unified Modeling Language is a language for visually representing the various aspects of the system (static, dynamic, behavioral). It is a standardized general-purpose modeling language in the field of object-oriented software engineering. The 'static' aspect deals with the structural nature of the system. The 'dynamic' view deals with the changing states of the system and the 'behavioral' view shows the behavior/functionalities of the system. Several diagrams are proposed in UML for depicting the various views of the system.

IV. DETAIL

Using Sensory Stimulation theory as the base, working of UNIX operating system can be learnt and taught by using Unified Modeling Language for effective understanding of the subject.

According to the literature survey, some facts were found with which study of UNIX can be related with UML. The behavior of the UNIX operating system can be represented with the behavioral diagrams in UML. This can be represented by using Use-Case diagrams in UML. The operational behavior of the UNIX can be divided into User Level operations, Kernel Level operations and Hardware level operations and these can be modeled as the use cases in UML.

UNIX comprises of various concepts like Buffer, Inode, Files, File subsystem data structures, Processes and Process subsystem data structure etc. These concepts can be modeled as Classes in UML. The structure of these classes can be elaborated and can be related together with the Class diagrams in UML. For example, files can be Regular, Directory or Special Purpose file. This can be shown with the generalization relationship in UML. All these files use the file subsystem data structures such as User file descriptor file table (UFDT), File table (FT) and Inode table (IT). This can be shown with a realization relationship, in UML, between the files and the file subsystem data structures.

The various algorithms for the functionalities in the classes can be depicted with the help of Interaction diagrams. This will make the understanding of the algorithm in a simplified manner. For example, the Open algorithm for a Regular/Directory File can be explained with a sequence diagram which shows the message passing of all the objects involved in the processes.

The various components of UNIX, hardware components, various libraries used by kernel and user interface, can be represented using the component diagram in UML.

V. Experimental Design

5.1 Instructional Material Design

To develop an instructional material investigator has followed the following steps. First of all to produce data to design instructional material, questionnaire and interview techniques of data generation were used. Interview was used during generating data from the teacher and questionnaire was used during generating data from the student. According to that topics which are difficult for learning from student's point of view and topics which are difficult for teaching from teacher's point of view are selected.

After that Using UML knowledge, different concepts and algorithms of UNIX are represented in the appropriate symbols and diagrams. Power point presentations are made for the same for delivering the lecture. Such a way UML tool for teaching UNIX is created.

5.2 Instrument Design

Instrument used to test the tool is nothing but a Test paper. Test papers were designed for the topics those are taught using this method. For this, three test papers each with 20 marks were prepared.

5.3 Hypothesis

Null Hypothesis (H₀) statement for this research is stated as "The understanding level of the student who studied internals of UNIX by traditional teaching method and the students who studied internals of UNIX using UML tool is same."

Alternative Hypothesis (H₁) statement for this research is be stated as "The understanding level of the student who studied internals of UNIX by using UML tool increases as compare to the student who studied internals of Unix by traditional teaching method."

5.4 Sampling

The research was of the type experimental hypothesis testing research since purpose of this research was to test a research hypothesis stated above by manipulating the independent variable i.e. type of teaching-learning. .

Random sampling was done i.e. samples were selected randomly from the population under consideration. For the research, population was the student studying at post graduation level, from those random students was chosen from class M.Sc. (computer science) for the experiment.

Two groups of the students were formed for the experiment. Students were selected on the random basis into these groups. Each group was containing 16 random students from the specified class.

For first group students, the selected topic of UNIX was taught without using a UML tool. This group is control group. And to other group students the same selected topic of UNIX was taught by using a developed UML tool which is based on the Sensory Stimulation Theory.

To perform the experiment, examination was conducted of the students from both the groups. Three examinations for the each topic were conducted. Separate test papers were used for each examination. Data was collected in the form of marks secured by the student in the each examination.

VI. RESULT

Marks secured by the control group students and the experimental group students are collected. In the current research, two independent samples say X (control group marks) and Y (experimental group marks) were collected from two normal population. Each sample was of size 16 i.e. m=n=16 t-test was used to analyze the equality of means of two populations.

Hence the hypothesis was formulated as below:

Null hypothesis H0: $\mu_x = \mu_y = 0$

$$Vs$$

Alternative hypothesis $\quad$ H₁: $\mu_x < \mu_y$

Summary of the t-test is displayed in the above table.

Table 1

Test Number	Test Statistics	
	T_0	$T_{critical}$
Test1	-4.6102	1.697
Test2	-5.9077	1.697
Test3	-5.0336	1.697

After comparing T_0 and $T_{critical}$ it was found that $T_{0 <} T_{critical}$ for all the three tests. So null hypothesis was rejected and accepted the alternative hypothesis.

CONCLUSION AND RECOMMENDATIONS

CONCLUSION

The idea of this research project was come from the fact that traditional teaching learning methodology is not sufficient and effective to transfer the knowledge of the internals of UNIX to the students. So investigation was started to find out the effective method to teach the internals of UNIX and this can be achieved using UML as a tool to teach internals of UNIX.

The results provide a consistent picture of the way in which it is observed that the understanding level of the student who studied internals of UNIX by using UML tool increases as compare to the student who studied internals of UNIX by traditional teaching method.

So application of the Sensory Stimulation Theory for developing UML based instructional material for teaching the internals of UNIX increases the performance and the understanding level of the students.

RECOMMENDATION

This research paper has selected some of the topics from the UNIX internals for developing the UML tool based on Sensory Stimulation Theory. In the future, one can develop the complete UML based tool to teach internals of the UNIX. tool.

Also this research work is based on the Sensory stimulation theory. Using this cognitive model one can also develop the multimedia based tool for other subjects to enhance the teaching learning methodology.

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