To Study Effectiveness of Teaching Operating System Using TWA model

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Abstract -In this Paper researcher study the effectiveness of a systematic model for teaching with analogies which can be implemented by an exemplary teacher and that students do derive conceptual benefit from instruction using the TWA(Teaching with analogies) based instructional material.. The study also has exposed new horizons and has begun to point the way for future studies of analogical learning. The changes made to the traditional teaching method were successful in improving the learning environment. TWA based instructional material made it easier to demonstrate the relevance and inherently interesting qualities of the course material. The students were more engaged in the learning process. TWA based instructional material work as pedagogical resources that will enable students to become subject familiar with the field, and to build a sound foundation for knowledge representation.

Index Terms—Analogy, Cognitive, Constructivism, Operating system, Pedagogical, Simulation, TWA,

1. Introduction

Operating System is most critical software in a computer system. OS' performance influences the performance of all software on a computer. At the time of software development programmer takes advantage of the design of the OS .Any software engineer then need to understand the environment offered by your OS What abstractions does the OS provide. Learning/Teaching Methods Used for Teach Operating System in Class Room

- Lecture/Demonstration of principles and techniques. These will generally be displayed directly from the instructor's computer monitor where applicable.
- Paper based labs to practice techniques.
- Hand-on labs to practice operating system functions
- Pairs and small group work to handle small problems related to the current material
- Study and discuss current developments in operating systems.
- Use of Simulation tool in class room for giving awareness of working of different algorithms like CPU scheduling algorithms, Process algorithms, I/O algorithms Page Replacement algorithms etc.

The overall goal for teaching operating system to allow students to become acquainted with the development and inner-workings of operating systems. One aspect of this knowledge is the use of analogies which can effectively communicate concepts to students of particular backgrounds and prerequisite knowledge. Indeed, analogies are considered to be an important component in the repertoire of effective teachers.

2. Literature Review

An higher level computing subject covering the theoretical concepts of operating systems is an essential part of any computing degree (Denning, 1989). The study of computing has three essential paradigms: theory, abstraction and design (Denning 89). An operating systems subject is very heavy on the theory. In such a subject providing the abstraction and design paradigms to enable students to fully understand the theoretical principles involved is difficult (Hartley, 1992. Withers and Bilodeau, 1992. Goh, 1992. Christopher et al, 1993). The provision of these paradigms to distance students is considerably more difficult.There have been various attempts to solve these problems. The 1992 offering of the operating systems subject of the Department of Maths and Computing at the University of Central Queensland (UCQ) made use of the Process and Resource Management System (PRMS) (Hays et al, 1990). The experience of using PRMS was not entirely successful.

Poor Design. PRMS suffered from numerous bad software engineering techniques including:

- The widespread use of global variables, a practice discouraged in every programming subject the students take.
- "Hard-wiring" as opposed to relative placement of graphical objects
- RMS was not portable. The system made use of functions specific to the Borland C environment.

This puts students not using this particular environment at a disadvantage.

Methods used to teach a subject in operating systems generally fall into one of four categories.

1. Purely theoretical and text book based

This method introduces concepts and explanations with no practical application or demonstration.. Many of the text books used in operating systems subjects follow this method (Stallings, 1992. Lister and Eager 1988).

2. The use of separate unrelated projects

This method uses separate practical projects to demonstrate a number of the important concepts. The projects do not meld together in any way and generally don't deal directly with an operating system.

3. Use of a simulated or cut-down operating system

This method involves the use of a simulated operating system (either in full or in part) which demonstrates the theoretical concepts. Additionally the simulation may not exhibit exactly the behavior of a typical operating system (1992. Goh, 1992. Ramakrishnan and Lancaster,1993). As a result the student must perform the conceptual leap from the performance of the simulation to real operating system behavior.

John M.d. Hill,Ray,BlairCarver(2003)come with different teaching style in classroom. According to them Because students have different learning styles, it's important to incorporate multiple teaching techniques into the classroom experience. They used puzzles and games in the classroom to reinforce the learning objectives.

(Alessio Gaspar, Sarah Langevin, William Armitage, Matt Rideout) r discusses the design and implementation of a set of laboratories for undergraduate courses in Operating Systems Concepts (OSC) and Networking(NET). More specifically, They focus on exploring how state of the art Linux kernel and virtualization technologies can be leveraged to implement new pedagogical strategies focused on problem-based, active and authentic learning.

(Xiaohong Yuan, Yaseen Qadah, Jinsheng Xu, Huiming Yu, Ricky Archer) has developed animated visualization tools named KERBEROS , which is an important teaching approach in computer science education.

(Juan Antonio Prieto Velasco & Marìa Isabel Tercedor Sànchez & Clara Inés Lòpez Rodrìguez-2006) have shown that it is possible to exploit multimedia documents in the scientific and technical translation classroom. Recent changes and advances in Information Technology have enhanced the role of multimedia in AVT (Audiovisual Translators). They considers multimedia contents from two points of view:

1. As pedagogical resources that will enable students to become familiar with the subject field, and to build a sound foundation for knowledge representation

2. As objects of translation meeting the requirements of accessibility. The translation of audiovisual documents activates the link between images and text, enables visualization, and triggers creativity.

3. Theoretical Framework

An important contribution to effective teaching and learning can be made by teachers' understanding of the central topics in each subject area and knowing how to transform their content knowledge into knowledge for teaching. One aspect of this knowledge is the use of analogies which can effectively communicate concepts to students of particular backgrounds and prerequisite knowledge.

3.1 Analogy and Instructional Design

An analogy is a process of identifying similarities between different concepts (Glynn, 1991). Analogy and metaphor are commonly used interchangeably. To be able to perceive the familiar in new situations is natural and unavoidable, otherwise all new experiences would seem strange and novel. The activity of constructing relationships between present knowledge and new knowledge is important to student learning processes.

3.2 The Advantages of Analogies in Teaching

1. Visualization Process

An analog which the student is familiar with, or has seen, is valuable in helping students visualize abstract concepts.

2. Real World Linkage

Presentation of a concrete analog within the students' real world facilitates understanding of the abstract concept by pointing to the similarities between objects or events in the students' world and the phenomenon under discussion.

3. Motivational Function

As the teacher is drawing from the students' real world experience, a sense of intrinsic interest is generated. If students are able to achieve a higher level of conceptual understanding than usual, this also can result in motivational gain.

4. Encourages the Teacher to Consider the Students' Prior Knowledge

Students' prior knowledge can influence the way they will perceive the new concept and it can be advantageous to consider their perspectives before teaching.

3.3 The Constraints of Analogies

1. Analog Unfamiliarity

The student is often unfamiliar with the analog, especially as the analog usually comes from the teacher. This will only cause greater confusion and misunderstanding if it is used. Teachers should try to choose analogs which are familiar to their students or explain the analog to the students to help remediate this problem.

2. Stages of Cognitive Development

If students lack visual imagery, analogical reasoning, or correlation reasoning, then the use of analogies is believed to be limited. In addition, those students already functioning at a high level may have attained an adequate understanding of the target and the inclusion of an analogy might add unnecessary information loads that could also result in new misconceptions being formed by the students.

3. Incorrect Transfer of Attributes

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The features of the target and analog that are not shared are often a cause of misunderstanding for the learners if they attempt to transfer them. When analogies are used during classroom instruction, discussion should take place to assist in defining the limitations of the analogy.

3.4 A Model for Teaching With Analogies

The following is a model (adapted from Glynn et al., 1989, p. 389) that a teacher could use when teaching with an analogy to improve the effectiveness of teaching and facilitate the correct application by the students. The six steps of the model are numbered from 1 to 6, however this is not a rigid pattern in which the steps must be implemented. Each step is important but the order in which they are used will depend on the individual teaching style, the particular concept and analogy being used and the lesson format the teacher wishes to follow.

1. Introduce the target concept to be learned

This can be anything from a brief introduction to a full explanation depending on how the analogy is to be utilised. If the analogy is to be used as an advance organiser, then the target concept would be introduced after the analogy. The analogy may be useful as revision. In this case, the target concept will be fully taught at this point.

2. Cue the students' memory of the analogous situation

Introduce the analog and identify how familiar the students are with it by questioning, for example.

3. Identify the relevant features of the analog

This involves explaining the analog, the detail of which depends on the students' familiarity, which should have been determined (see step 2), and identifying the relevant features.

4. Map out the similarities between the target concept and the analog

The relevant features of the target concept are outlined and clearly linked with the corresponding features of the analog.

5. Indicate where the analogy breaks down

During the use of the analogy, any misconception the students may be developing should be noted. The teacher should be aware of any other areas where the analog and target do not correspond. These should be pointed out to the students so that they are less likely to draw incorrect conclusions about the target from the analogy. This step can be incorporated at any appropriate point.

6. Draw conclusions about the target concept

By allowing students to make use of analogies, they can take an independent approach to learning and tackle an unfamiliar concept using analogical reasoning to build more cogent understanding. One of the most basic tools used in good teaching is a strategy to find a way to tap student's prior knowledge. Analogies may do just that. The purpose of this paper is to review literature on analogical reasoning to propose an alternative approach of instructional design based on the use of analogical reasoning. Justification of the model is based on research on the nature of analogical thought and an examination of analogous design models from other fields.. So analogy is a linguistic expression corresponding to some cognitive process of transferring information from a particular subject (the analog) to another particular subject (the target), In a narrower sense, analogy is an inference or an argument from one particular to another particular, as opposed to deduction, induction, and abduction, where at least one of the premises or the conclusion is general. Designing effective instruction for graduate or post graduate level students that enables them to apply operating system theories in their system software development , depends on some integrated theories which can contribute to meaningful learning .

3.5 Cognitivism and Instructional Design

Cognitive science began a shift from behavioristic practices which emphasised external behavior, to a concern with the internal mental processes of the mind and how they could be utilized in promoting effective learning. The new models addressed component processes of learning such as knowledge coding and representation, information storage and retrieval as well as the incorporation and integration of new knowledge with previous information (Saettler, 1990). The goal of instruction remained the communication or transfer of knowledge to learners in the most efficient, effective manner possible (Bednar et al., in Anglin, 1995). For example, the breaking down of a task into small steps works for a behaviorist who is trying to find the most efficient and fail proof method of shaping a learner's behavior. The cognitive scientist would analyze a task, break it down into smaller steps or chunks and use that information to develop instruction that moves from simple to complex building on prior schema.

The influence of cognitive science in instructional design is evidenced by the use of advance organizers, mnemonic devices, metaphors, chunking into meaningful parts and the careful organization of instructional materials from simple to complex.

3.6 Constructivism and Instructional Design

The shift of instructional design from behaviorism to cognitivism was not as dramatic as the move into constructivism appears to be, since behaviorism and cognitivism are both objective in nature. Behaviorism and cognitivism both support the practice of analyzing a task and breaking it down into manageable chunks, establishing objectives, and measuring performance based on those objectives. Constructivism, on the other hand, promotes a more open-ended learning experience where the methods and results of learning are not easily measured and may not be the same for each learner.

While behaviorism and constructivism are very different theoretical perspectives, cognitivism shares some similarities with constructivism. An example of their compatibility is the fact that they share the analogy of comparing the processes of the mind to that of a computer. Consider the following statement by Perkins:

"Information processing models have spawned the computer model of the mind as an information processor. Constructivism has added that this information processor must be seen as not just shuffling data, but wielding it flexibly during learning -- making hypotheses, testing tentative interpretations, and so on

3.8 Use of Analogies in Operating System

For developing instructional material for teaching operating System Various difficult topics are identified for develop analogy on them, they are:

1. Fragmentation

As processes are loaded and removed from memory, the free memory space is broken into little pieces. External fragmentation exists when there is enough total memory space to satisfy a request , but the available spaces are not contiguous; storage is fragmented into large number of small holes..

Analogy –Train reservation

The analogy used for this concept is Train reservation. In which reservation is done according to demand of passengers Let ten birth are available from 1-10 and passenger reserve birth in following fashion according to their requirement: [1-3, 5-6, 8-10 (reserve birth)] [4, 7 (unreserved birth)]So if new demand is generated for reserve two contiguous seats then request will be refused, because two seats are available but not in contiguous order , which is equivalent to external fragmentation. Again let reservation is full, and demand for one birth is generated in this case the demand is goes into waiting state , but if at the time of journey if passenger in not travel then seat is remain vacant since, reservation is not cancel and it cannot be given to another. This strategy is equivalent to internal fragmentation.

2. Paging

Paging is a memory management scheme that permits the physical address space of a process to be noncontiguous. The basic method for implementing paging involves breaking physical memory into fixed sized blocks called frames and breaking logical memory into blocks of same size called pages. When a process is to be executed, its pages are loaded into fixed sized blocks that are of the same size as the memory frames. Every address generated by CPU is divided into two parts: a page number (p) and a page offset (d). The page number is used as an index into a page table. The page table contains the base address of each page in physical memory. This base address is combined with the page offset to define the physical memory address that is sent to the memory unit .

Analogy – Book Contents

Lets we are having syllabus of new semester, For search any topic of syllabus from the book , we use contents of the book. Contents of book will give page no. of the book where the topic is resided. Here, Syllabus is equivalent to logical memory, which is very lengthy & may contain topics from more then one reference books. Content of book is equivalent to a page table in paging concept , which give the actual address of physical memory where the page is resided.

3. Segmentation

User prefers to view memory as a collection of variable sized segments, rather than to be a linear array of words. There is no ordering necessary among segments. There may be segment for each of subroutines , arrays, procedures, or functions and modules appearing in a user program. Segmentation is a memory-management scheme that supports this user view of memory. A logical address space is a collection of segments. Each segment has a name and a length.

Analogy- Library System

In Library Books are resided in different book shelf. Books are categorized according to subjects. Each book- shelf have name and capacity. Here each shelf is behave like a segment. And library is equivalent to memory space.

4. Virtual Memory Concept

In computer jargon, virtual is something that appears to exist, but actually does not exist. Virtual memory is a technique, which allows execution of the process that may only partially be present in the memory. So, Virtual memory allows program can be larger than the memory allocated to it.

Analogy- Website surfing

When user surf any website, user think that all content of website and data of the site, including data on links are now available to him, and reside in his computer. But actually data are completely not resided into user PC. Only those WebPages are come from Different server, which are click and need to accessed. Here Web site is a program which user thinks that completely available in memory. However it may be possible that size of website may be very large then the capacity of memory.

5. Demand Paging

In the demand paging as the name suggests, a page is demanded/requested by the user program and if it is not present in the memory, it is given to the user from secondary storage device.

Analogy – Google search

In Google search, user search for a particular Topic. Pages related to the specific topics are list out and then user open Web page which is required by user. Here Pages comes in to the user memory from server only when they are clicked, that means when they are demanded. So web Pages are equivalent to pages of logical memory and server is equivalent to physical memory where actually pages are resided.

Analogy

People are like process in that they can each work on a task independently of other people, and in that they often cooperate on tasks or complete for resources. For example, suppose one person is addressing envelopes containing wedding invitations, and the other person is putting on the return address, sealing and stamping them. The (human) "addresser" produces the addressed envelopes one at a time , and can never get ahead of the stamper/sealer since the addressed envelopes will not exist yet. The coordination happens naturally.

4. Experiment Methodology

In this experiment, researcher use two group experiment design. This is the simplest type of experiment in which two groups are created, Which are equivalent to each other. One group (the program or treatment group) gets the teaching using TWA based instructional design material. And the other group (the comparison or control group) does not. In all other respects, the groups are treated the same. They have similar student, live in similar contexts, have similar background and so on. Now, the difference which we observe in outcomes is only due to the thing that differs between them –that one received the TWA based teaching and the other didn't.

4.2 Sampling

The approach used in experiment design is to assign student randomly from a common pool of people into the two groups. for random selection the Roll no. of the students are write to chits and then put all chits into the box, and randomly twenty chits are selected from the box for group one and remaining roll no are goes into second group.

4.3 Development of Study material

4.3.1 Data Collection

For selecting difficult topics and concept from the operating system subject the teachers was interviewed.

1. Interview

Objective of the interview was to first help the teacher to self identified that which topics, concepts and algorithms are really became very difficult to teach. The second reason was identified concepts which required analogies to increase degree to which students understood the lesson's concept(s).

2. Questionnaire

For finding the difficult topics from operating system subject Questionnaire is distributed among students .Close ended Questionnaire, which consist twenty one questions on different topics of operating system is used.

4.4 Design of instrument

After completing every lecture session exam was conducted, which is divided on two objective type question paper. One question paper is having questions on basis of rating and another having pure objective type questions. So total eight question paper are Prepared which are well design and verified by expert.

4.5 Conduct of Experiment

The instructional material is developed lecture wise to take 20 min. lecture of the students. Total eight Lectures are designed in which, four lectures are based on instructional material and four are based on traditional method. After that experiment on two groups are conducted . Four lecture on one group of twenty five students and four lecture on second group of other twenty five students.

One group (the Experimental or treatment group) gets the teaching using TWA based instructional design material. And the other group (the comparison or control group) taught by using traditional blackboard method. In all other respects, the groups are treated the same. Two Lectures are taken alternative in a day. One lecture in morning session which is on control group and second lecture in after noon session which is on treatment group. So total four days which are prescheduled, utilized for conducting whole experiment of lecture. After each lecture session Exams are scheduled So question Paper are given to the student. After each Exam, Evalution and analysis done.

5. Results:

CPU Scheduling – Paper

Table 1 Results of CPU scheduling Test

CPU scheduling		
Sno.	control	experimental
1	5	3
2	7	3
3	1	4
4	1	4
5	2	5
6	2	5
7	3	6
8	4	6
9	6	7
10	4	5
11	5	7
12	2	10
13	5	7
14	5	7
15	6	10
16	3	6
17	3	6
18	9	7
19	8	9
20	7	8

Table 2 Results of Paging Concept Test

Paging Concept		
Sno.	control Group	experimental
1	5	3
2	3	2
3	6	6
4	4	6
5	4	4
6	6	4
7	7	5
8	7	5
9	4	6
10	6	7
11	7	7
12	8	5
13	4	7
14	4	8
15	8	8
16	9	8
17	5	8
18	2	7
19	1	9
20	3	7

Table 3 Results of Virtual memory Test

Virtual memory		
Sno.	control Group	experimental
1	6	4
2	1	4
3	2	3
4	5	3
5	5	9
6	3	7
7	7	6
8	3	7
9	8	6
10	4	5
11	4	8
12	4	8
13	4	5
14	1	7
15	4	9
16	3	7
17	3	4
18	6	5
19	4	2
20	5	9

6. Conclusion

It already has been acknowledged that this aspect of teaching science with analogies is vast and diffuse This study has done no more than show that a systematic model for teaching with analogies can be implemented by an exemplary teacher and that students do derive conceptual benefit from instruction using the TWA based instructional material.. The study also has exposed new horizons and has begun to point the way for future studies of analogical learning. Students learn concept through constructivism and positive cognitive structure is improve in their mind. Results of the exam was improve due to proper understanding of concepts.

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