Research Study in Comprehensive Course: Operating System

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***Abstract*- Today, most engineering institutes focus on incorporating research in education. Students need to involve themselves in research and this is possible in comprehensive course as they have to be pertinent in few concepts of the course that is not thought in the class. The comprehensive course brings an ample knowledge about the course, students show wide range of interest to explore course concepts.This paper refers to the comprehensive course-"Operating System" that focuses on research based learning such that the students get an extensive knowledge on how operating system conceptsare used in the current technologies and how the problems are solved using the same by studying research papers. They also learn how to read and perceive research papers. This helps students to indulge themselves in research based learning; also it would be the stepping stone to students to pursue higher studies in the field of research. Students will be able to make important contributions to the industry, if they are well versed in current technologies.**

***Index Terms*— research based learning, operating system, comprehensive course, and self-study.**

I. INTRODUCTION

In engineering, there are three types of courses: integrated course, non-integrated course and comprehensive course in curriculum. Integrated course is a course that has theory and practical components, non-integrated courses have only theory in it where as comprehensive course has theory, practical and self-study components. Theory is the lectures delivered by faculty, practical is the laboratory sessions and self-study is a component in which students actively learn in groups and perform assigned tasks which could be project-based, seminar or research based learning.

Operating System is a comprehensive course in which practical components covers the implementation of few operating system functions which manages the system resources. To be briefer an operating system is a program that manages a computer's hardware. It also provides a basis for application programs and acts as an intermediary between the computer user and the computer hardware. Operating systems exist because they offer a reasonable way to solve the problem of creating a usable computing system. The fundamental goal of computer systems is to execute user programs and to make solving user problems easier. Computer hardware is constructed toward this goal. Since bare hardware alone is not particularly easy to use, application programs are developed. These programs require certain common operations,such asthose controlling the I/O devices, process and memory management.

The assignments given to thestudents this course are feasibility studies for new technologiesrelated to operating system. This study requires them to do background research by surveying the literature, synthesizing information and applying the knowledge and understanding of operating systemconcepts. The tasks set for students do not have a 'right answer'and the point of these activities is to develop students' ability to locate and use resources,critically analyze the evidence and produce good presentation and technical writing. These skills, alongwith teamwork, are considered important when working in industry.

With respect to the content of learning, it is possible to distinguish between approaches that have a focus on understanding key concepts of operating systems or acquiring general thinking strategies, on the one hand, and approaches with a large amount of hands-on activities or fact recall concerning specific information, on the other hand[3]. The approach discussed in this paper emphasize the importance of key concepts or big ideas that are learned in depth and can be transferred to different situations in research study. Often, these skills include meta-cognitive skills and problem-solving abilities such as problem analysis, inference making and hypothesis testing [1].

Although knowledge creation/knowledge building can go on without technological assistance—and often does in adult knowledge work technology can provide multiple methods of support that could be helpful in many work contexts but that have proved essential in enabling students to carry through efforts at knowledge creation[2].

As a faculty we try to explore the dynamics of a teacher community committed to continually improving their practices so that they are able to advance beyond "best practice." The teachers in this community are engaged in collective knowledge building, in their interactions with each other, as part of a larger professional development community, and in their work with their students. Knowledge building is a social process focused on the production and continual improvement of ideas of value to a community [4] For example, the principle of "community knowledge, collective responsibility" emphasizes that contributions to shared, top-level goals of the community be rewarded as

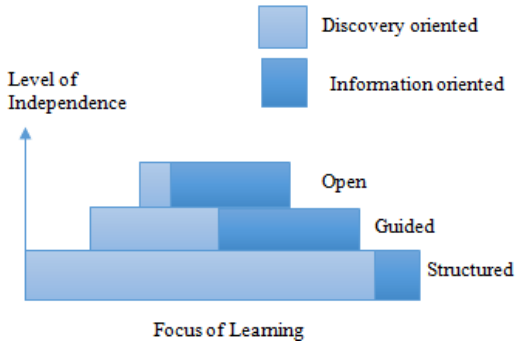
much as individual achievements and that community members produce ideas of value to others and share responsibility for the overall community knowledge advances [5]. The set of principles enables a theoretically-guided or principle-based design approach to teaching practice (Hong, Scardamalia, Messina, &Teo, 2008; Zhang, Hong, Teo, Scardamalia, & Morley, 2008), as contrasted with conventional classroom work defined by pre-specified procedures, clear scripts and rules, or componential tasks (see, e.g., Dick & Carey, 1990; Gagne, Wagers & Briggs, 1992, Mager, 1975; Merrill, 1983) or any highly-structured teaching activities that represent fixed rather than improvable classroom procedures (Hong & Sullivan, accepted). The purpose of this exploratory study is to uncover the nature and document the process of how these teachers worked together as a community and engaged in sustained knowledge advancement.

II. Scope

Students wereassigned a research study keeping in mind that they had to work on more project-based learning in their further semesters. The research study in this course would help them in not only reading, understanding and analyzing the research paper, but also they would typically start researching to delve into a topic and perceive the concepts to the core.

As in research based learning students have independence in learning and working on a particular assignment.The below diagram presents the relationship between the level of student independence and the focus of their learning through the scaffolding metaphor – more teacher support corresponds to the wider base at the bottom, while increased student independence (and hence less support from the teacher) is as shown at the top. The three modes of enquiry referred to in this model are:

- structured – teacher provides question/problem and explains how to address it;
- guided – teacher provides question but students explore it themselves;
- open – students formulate and explore questions themselves.



Source: Spronken-Smith and Walker (2010)

This will help the students to continue to work on a particular concept, they can further build solutions to problem using latest technology stack in their higher semester comprehensive course. Hence students were given such learning as self-study component so that they are now molded to read, understand, analyze, synthesize and later be able to write their own research paper in higher semesters. Students gain ample knowledge in research by active learning in groups. They are also able to work effectively as a team member and perform well as an individual in oral presentations.

III. Implementation

Students were given operating systems concepts to teams of two students and were asked to search for a recent peer reviewed journals on that particular topic. The students were thought how to search for a right paper and how to read a research paper. The importance of references were also been conveyed to students. This assignment was a graded one and the assessment process is as follows:

Students were thought how to select and read a research paper. They were educated with questions like what are peer reviewed journals. How references are used, its importance. How to select a paper. Importance of recent papers. Research study in a comprehensive course was cumulatively assessed. The students were asked to choose a relevant research paper from a peer reviewed journals on a particular concept in operating system course. The assessment pattern involved two reviews:

In review (I) they had been asked to explain the concepts that had been assigned to them with suitable examples and also present the crust of the paper selected using PowerPoint presentation.

In review (II) students had to explain howthe given conceptswere used in the paper for research. Their analysis on the concepts lead to a few cases who were also able to synthesize and further improvise by studying related papers on same concept. Students had to write a technical paper on the research study they had perceived in the semester.

IV. Impact

Research study in comprehensive course to students provided them more depth and scope of understanding in an operating system course. Also they are able to read a research paper and are motivated to write a research paper in future. They are able to work in teams and perform well as an individual by effective oral presentation.

Knowledge building practice, in contrast, involves a more dynamic and integrated approach in which facilitators reflectively move between principle-based pedagogical ideas and practical strategies with the goal of advancing both. It capitalizes both on the strength of design and that of adventurous teaching, allowing new problems to emerge or

recurrent problems to be re-defined and transformed for progressively more advanced problem-solving, with unplanned, new learning designs collaboratively improvised through classroom interaction (Zhang et al., 2008). This represents an important form of teacher professional development aimed at cultivating more reflective and innovative teachers [7].

In the course end survey it was noted that,

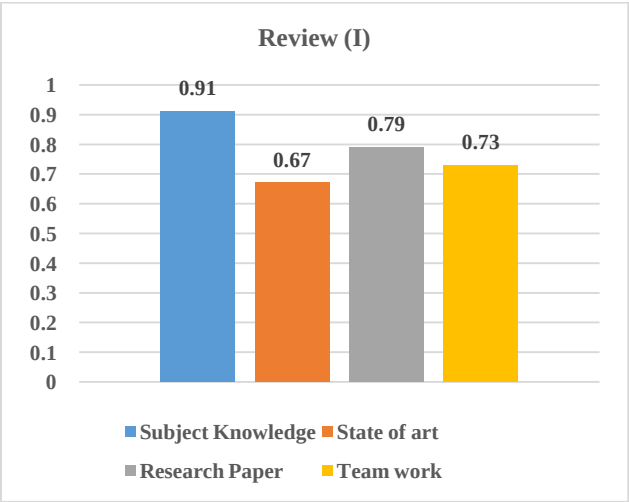
60% students had good experience in research based learning in comprehensive course, 30% students had very good experience and 6.7% students perceived it hard initially and later they could cope up.

40% students were able to read and understand research papers.36.7% students were able to understand and analyze the operating system concepts 20% students were able to synthesize the real time concepts of operating system. 3.3% found research based learning hard.

96.8% students perceive research based learning provided them more depth and scope in understanding the subject matter.

V. RESULTS

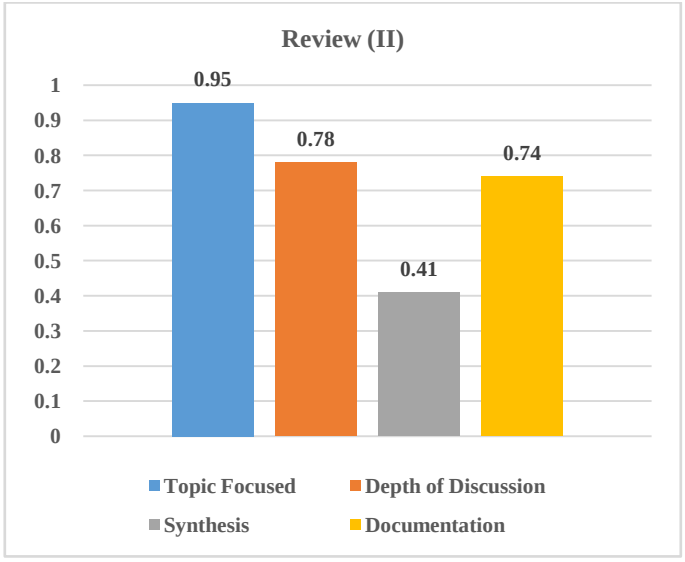
In review (I) there were four rubrics evaluated: Subject knowledge, state of art, selection of research paper and performance of the student as a team member. As per observations 90% of the students perceived excellent subject knowledge they were able to explain the concept clearly and effectively, they were thorough with concepts and were able to answer the panel questions that is state of art was up to 60%, most of the students selected right papers from peer reviewed journals, few selected good white papers which is 79% and students worked efficiently in teams which marked to 73%.



The average of students performed as expected was 70% in a class in review(I).

Total	>=3	%
58	41	70.68966

In review (II) there were four rubrics evaluated: topic focused, depth of discussion, synthesis and documentation. As per observations 95% of the students were well focused on the topic they could now judge and know in which all current areas this particular concept could be used, 78% of the students were able to analyze and convey to the teacher the usage of the concept or technique, its pros and cons of using a mechanism in different environment of operating system, 41% of the students could synthesize by gaining knowledge by reading two or more related papers where as others tried but were not up to mark, and 74 % of the students wrote right technical report (correct format) on the research study of this comprehensive course.



The average of students performed as expected was 86% in a class in review (II).

Total	>=4	Performance Percentage
58	50	86.2069

The below table summarizes the overall performance of the students with respect to both reviews. The comprehensive course was a success with 75% of the students performed as expected. The remaining 25% students could not reach up to the mark as they were not much open to research based learning.

Review(I)	Overall	78%
Review(II)	Overall Percentage	73
Self-Study	Total percentage	75

The below table shows the overall performance of the students with respect to grade they earned in the self- study component.

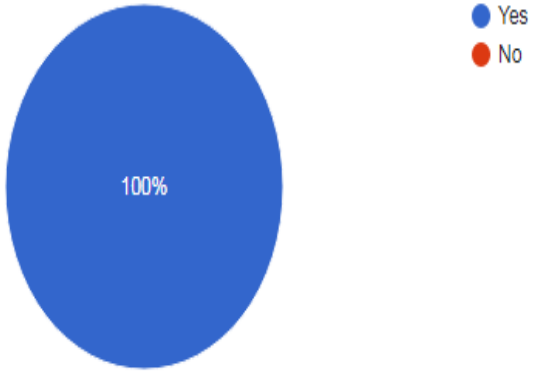
Out of 58 students 52 were able to score 70% of the allotted marks to self-study. The performance could reach 89% as the students worked hard in research based learning.

Total No. of students	No. of Students achieved	Achieved 70% of marks in %
58	52	89%

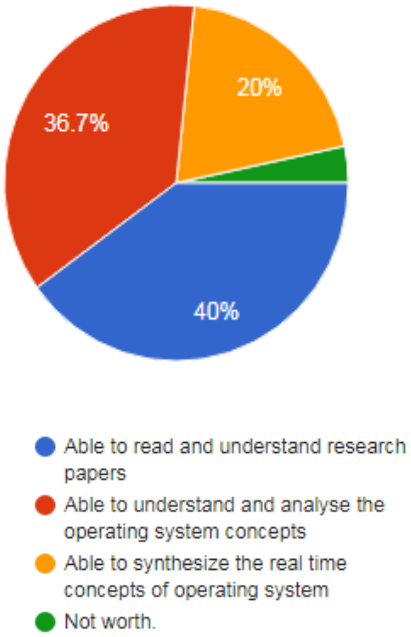
Student Feedback Report

1. How the experience in research was based learning

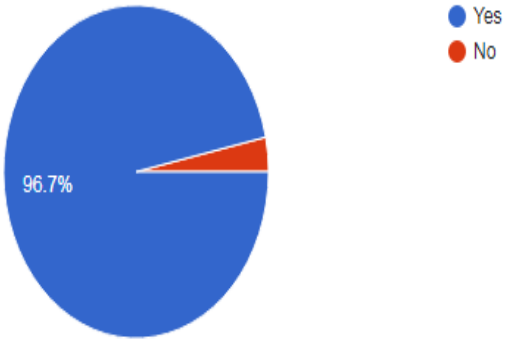
2. Was the resources available for the study?



3. What knowledge have you gained by research based learning?



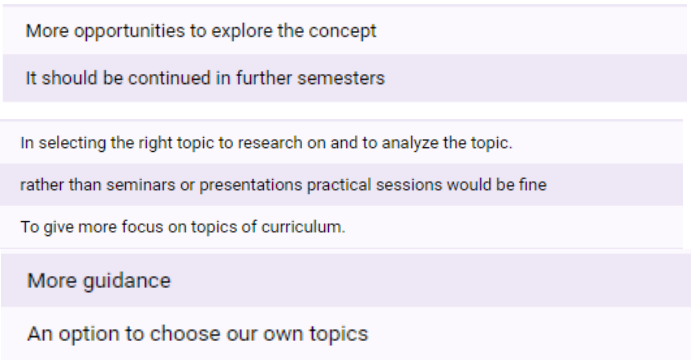
4. Research based learning provided us more depth and scope in understanding the subject matter.



5. Did you have any difficulties in research based learning?

Finding new papers was hard because most papers require payment just to view and read them
Initially, there were some difficulties, but were later solved.
selecting relevant papers
If proper research paper is obtained, then no problem.
It was understandable
Initially I found it slightly difficult. Eventually it seemed to get easier.
To analyse research paper

6. What suggestions do you have to improve research based learning?



As per the feedback the research based learning was nearly successful. Further based on the students suggestion and experience research based learning can be improvised by providing expert researcher lectures and can be continued in next semester by integrating project based learning with research based learning such that the students can be encouraged to write research articles in higher semesters.

VI. Conclusion

The approach implemented in the comprehensive course was totally new to the students. They initially took time to understand the learning and assessment pattern and later could cope up with this approach. The review I was very stringently done which actually helped the students to take it seriously and perceive the knowledge on research. Students were extremely good and potential to take this new challenge. As per the feedback report the students suggested to provide more time and need to continue this type of learning in higher semesters such that they will be motivated and molded to do project-based learning with research that can lead them to write a technical paper in each of their higher semesters.

References

[1]. Van den Broek, G. (2012), "Innovative Research-Based Approaches to Learning and Teaching", OECD Education Working Papers, No. 79, OECD Publishing.
[2]. Bereiter, C. &Scardamalia, M. (2014). Knowledge Building And Knowledge Creation: One Concept, Two Hills To Climb. In S. C. Tan, H. J. So, J. Yeo (Eds.) Knowledge Creation In Education (Pp. 35-52). Singapore: Springer.
[3]. Bereiter, C., &Scardamalia, M. (2008). Toward Research-Based Innovation. In C. for Educational Research & Innovation (Eds.), (Tran.), Innovating to Learn, Learning to Innovate (67–87). Organization for Economic Co-operation and Development (OECD).
[4]. Scardamalia, M., &Bereiter, C. (2003). Knowledge Building Environments: Extending the Limits of the Possible in Education and Knowledge Work. Encyclopedia of Distributed Learning, 269–272.
[5]. Scardamalia, M., &Bereiter, C. (2003). Knowledge Building. In 2nd (Ed.), (Tran.), Encyclopedia of Education (1370-1373). New York, NY, USA: Macmillan Reference.
[6]. Spronken-Smith, R. and Walker, R. (2010). Can inquiry-based learning strengthen the links between teaching and disciplinary research? Studies in Higher Education, 35-6, pp. 723-740.
[7]. Huang-Yao Hong Towards design-based knowledge-building practices in teaching, Proceedings of the 8th International Conference on Computer Supported Collaborative Learning, CSCL'09, Rhodes, Greece, June 8-13, 2009, Volume 1
[8]. https://greatresearch.org/2013/11/01/the-relationship-between-teaching-and-research/