Research Based Approach on NS-2 for Post Graduation Course

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Abstract: In order to emphasize research at post graduatelevel it is essential for making teachers and students aware of the importance of acquiring essential research skills along with technical skills through the project based learning activity to promote post graduate students like Master of Computer Applications towards research. An attempt is made to promote their interest towards computer networks using Network Simulator-2 to build their own network topology, protocol and performance analysis of different protocols, which they have studied in theoretical approach can be simulated using NS-2 tool and a prototype of various network topologies can be built to enhance interest among students to carry out research based projects using NS-2.

Keywords:NS-2, Protocols, Topology, Performance Analysis,prototype.

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1. INTRODUCTION

Technology is dramatically changing educational research processes, at a time of high demand for 'evidence-based' policy and practice. It will interpret and evaluate research in technology rich environments. Everybody is engaged in the critical study of original empirical research to learn about cutting edge methods of data collection and analysis. Philosophical assumptions underlying educational enquiry are to be examined [2]. The Importance of research in higher education says that knowledge is enough to make productive career but nowadays competition is so tough that higher education is a must to make a mark at higher level. It doesn't really matter that whether we are interested in history or science, computer or management, higher education will provide the extra bit of ease to pick up much required speed at corporate level in beginning. But the main issue is how to make higher education more productive [3]. It does not depend on university or college to be selected or it's a course of individual interest selection that makes all the difference.

Behind the classroom door, key factor in the success of aconcept, in determining whether the students actually learn something that matters, is the creative ability of the teachers to combine theory and practical classroom experience. Theory alone will not result in effective teaching. Critical to this process is the teacher's knowledge of the subject content, and his/her ability to implement new strategies, to develop effective performance tasks, to design appropriate assessment tools, and to address the different student learning styles. Little of this can be accomplished if teachers are not knowledgeable of new research tools, and further determined to implement it. Effective teaching therefore involves the practical application of theoretical concepts explained in a classroom environment. This paper

demonstrates how the implementation of new educational research improves both pedagogical practices and student learning. Special attention is given to the transformation of one historical re-enactment from an entertaining classroom activity to an effective performance task.

2. CURRENT STATUS OF INVOLVEMENT OFPOST GRADUATES STUDENTS INRESEARCH IN COMPUTER NETWORKS

Computer network is a course that provides students with the skills to design implement and manage computer-based systems using software and networking technologies. The theoretical knowledge of computer networks that are taught in the formal class rooms does not provide students a hands on experience to observe various networking behaviours in their real time usage, and practical difficulties in handling networks. Real time implementation of computer network is a tedious process, so networks are simulated before they are physically demonstrated. At the post graduation level like MCA there is lack of research oriented approach towards computer networks. The previous surveys indicate the lack of research interest in the post graduation level and this motivated us to experiment a research based approach to teach computer network and to enhance the interest of PG students to do their academic projects in computer networks using new technologies and tools like NS-2,Wireshark, Dumpsec etc., and to involve themselves inresearch activities after their PG course. Thus we incorporated NS-2 in an effective manner to make the students to experiment all theoretical concepts taught. This hands on experience, problem solving and designing will encourage students to do better academic projects using NS-2.

3. DESIGN AND IMPLEMENTATION OF ASSIGNMENTS

The proposed activity of simulation on network was taken up as a core course for second year MCA students under computer network laboratory for a batch of 45 students. The proposed activity aimed at designing network topologies based on theory of computer networks and practical sessions in NS-2. Given activity is divided into 3 phases namely understanding the network behaviour, designing of network topology and implementation using NS-2 tool by writing Tcl scripts. The course computer network lab has 9 different experiments, each with a set of sub tasks. Each student need to follow the list of the experiments analyse and identify the problem and iterate them using the theoretical concepts of computer networks. Students used segregation to identify the scope, potential and constraints under each iteration before problem to be solved. In order do good research it is necessary for creation of good questions and selection of appropriate problem.

Students seek out information from sources such as text book and journal articles on NS-2 to solve problems on computer network course syllabus. Student followed research based learning approach to explore an issue in assigned problem area, followed an iterative process to narrow down to a specific problem of interest. They were able to scan for variety of problems to divergent process initially and later converging towards the given problem by limiting the scope and following feasibility constraints. Students used a set of research materials on computer networks and NS-2 while doing diverge and converge process. The process of convergence and divergence is iterated in successive steps before they finally solve the problem. Every phase of the activity was documented neatly by students as they progress through the activity. Students were given a set of guidelines for reading research articles and writing summary on their own. Student collected information from the short listed text book and papers.(list of NS-2 materials/papers)

Student could identify the keywords in the problem that helped them to identify the resources needed to solve a problem. Students were able to make connection between given problem statement, the identification of required technical knowledge and solution to the problem. The collected data from the survey done, shows that students took very good interest in problem solving activity. Student could arrive at problems related case studies like measuring network performance bottle neck in thenetwork, simulating link errors, simulating file transfer, bandwidth sharing between TCP and UDP, analysing IEEE 802.11 MAC protocol, analysing and avoiding network congestion etc.. . They used various dynamic routing protocols and knowledge of TCP, UDP protocols and their behaviour to solve the problem. Later they verified the results using Xgraph and demonstrated the solution. The activity involving are analysing the given problem, designing the network topology and implementation using NS-2 tool.

4. TEACHINGSTRATEGY

As teacher is aiming at developing of the critical skill of the student, soft skill development is included as an important objective under the course syllabus. A session of three hours duration was planned and included in a syllabus to explain to students the objective set, structure, scope, schedule, evaluation scheme, outcome and benefits at the beginning of the activity. The teacher in the whole process acts as a guide rather than instructor. The teacher‘s strategy is firstly to convince student for understanding the relevance of undergoing the activity. Students are provided with the set of standard guidelines for reading NS-2 materials and IEEE papers for understanding various routing protocols and behaviours of transmission protocols.

During the activity monitoring, the teacher was responsible for clearing the queries through the demonstration of examples and by supplying the relevant study materials. Students are the necessary inputs through regular interaction with teacher as per plan. The objective

of the teacher is to promote research based learning rather than formal teaching based methodology. [3]

Students develop any skills through hands on practice rather than oral presentations are undergoing demonstration. Hence the teacher involved needs to constantly motivate student to achieve the skills and provide constructive feedback on their performance. It is a challenging task for teacher to develop research skills in students as it linked to attitudes and values which cannot be easily measured. Teacher needs to relate these skill development activities to their professional careers. Teacher as mentor needs to keep track of the progress achieved by each student by constant feedback and follow up as per schedule.

5. ASSESSMENT

Evaluation was carried out based on review process as it was an individual activity for a group of 45 students; the student was able to learn NS-2 tool set based on materials and shortlist three to four relevant papers in the assigned area to solve the problem. Thus each student was engaged actively in problem solving phase and was able to review research article individually and summarize. The review process was divided into three phases accordingly to have weightage 40% of total marks for first phase and 60% weightage of marks shared by other two phases. Assessment strategy was mainly based on students to solve problem on their own using research techniques instead of solving them using formal teaching methodology. There was an equal importance given to evaluation to both technical competencies as well as for higher skill developments.

It was a challenge for a teacher to design a technique to extract information on attainment of skills which cannot be easily quantifiable. There is a requirement for measuring the level of attainment of soft skills based on methods adopted to solve the problem, documentation of the work, preparing their own report, self assessment and stress management techniques.[2] Student can review their own progress on their won through the questionnaire applied by mentor and improve themselves to achieve desired objectives.

6. RESULTS AND FEEDBACK

Research based learning offers a wide range of benefits to both student and teachers. This was evident from the performance of student as well as their response collected against the questionnaire for the activity to measure their satisfaction. The tables 1, 2 and 3 shown below explains the performance of the student measured through continuous evaluation. Table 1 compares the performance of student in the 3 activities.

That is traditional approach contributing to 50% and research based activity contributing to 50% of the total internal marks respectively. It is evident that students showed good interest in research based approach as compared to traditional approach. This is evident even from the bar chart shown in Figure 1 based on data collected in Table 1. It can be noted that number of students who have scored less than 40% has drastically reduced from 25 to 10 students while comparing the two activities.

Further the data collected based on results of performance of students through reviews and also through data collected by project works carried out using NS-2 tool on computer networks is shown in Table 2. It is evident that research based approach could achieve higher level of learning in line with ABET criteria addressing a,b,d,f and j outcomes better as compared with formal teaching methodology. The tabulated data and corresponding bar chart presented in Figure 2 reveals that students have realized the benefit of undergoing the activity. The tabulated data and analysis on projects that are carried out during 6 semester MCA, where the number of projects on computer networks has nominally increased compared with previous projects as shown in Table 3, which reveals that research based approach using NS-2 has created an interest among students to carry out projects as presented in bar chart in Figure 3

Table 1: Comparison of performance of students in research based approach as compared to traditional approach

No of students falling in score range (%)	(Below 40)%	(40-59)%	(60-79)%	(80-100)%
Marks through traditional approach	25	9	7	4
Marks through research based approach	10	12	8	15

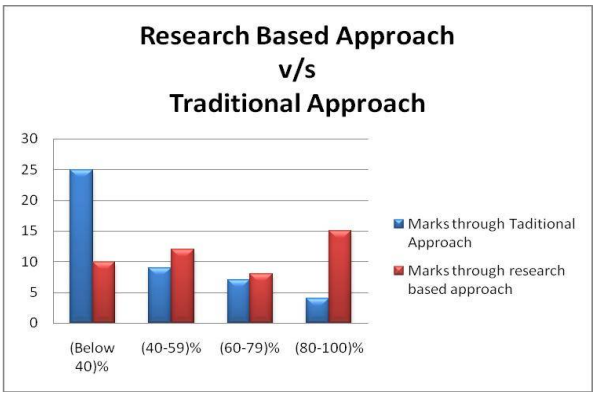

Figure 1: Bar Chart of data collected in Table 1

Table 2: Performance of students through reviews.

Factors measured based on reviews	Attributes (%)		
	Review 1	Review2	Review 3
Problem analysis	56%	80%	93%
Literature review	62%	87%	91%
Implementation and verification	42%	60%	87%

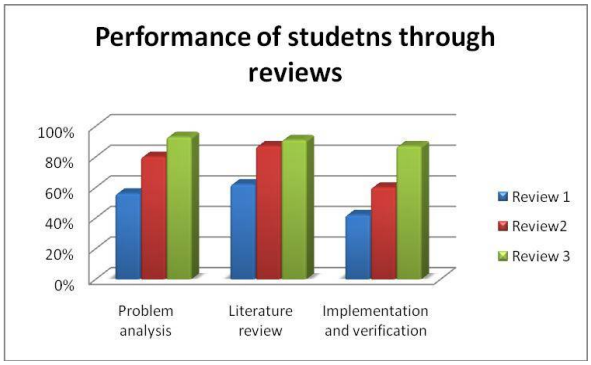

Figure 2: Bar Chart of data collected in Table 2

Table 3: Number of projects carried out using research based approach using NS-2

Project works on computer networks	**Attribute in %**
Data collection before research based approach	17
Data collection after research based approach using NS-2	51

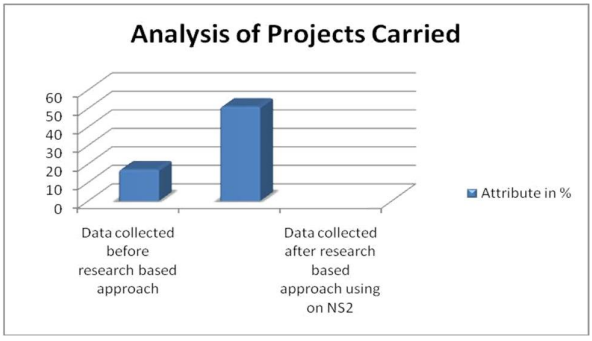

Figure 3: Bar Chart of data collected in Table 3

7. CONCLUSION

The proposed approach to carry out network assignment using NS-2 proved to be successful. The positive response of the students motivated faculty to pursuer similar kind of approach in computer networks and other courses. As it was the activity done for the first time there was scope for improvement in the assessment to be used for measuring skills attained by students. Objectives of the activity cannot be met through one such activity in single semester but on regular basis under every semester from first year of MCA in one or more of the courses offered. Such an activity planned in every semester can definitely help students strengthen their skills and knowledge in a phased manner. This activity has proved to be very essential in making teachers and students aware of the importance of acquiring essential research skills along with technical skills through the project base learning activity. These activities certainly enhance the development of organisational and self management skills of teachers and students.

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