# Effective Learning of Computer Networks and Security using Problem Based Approach

Anitha H M<sup>1</sup>, Sowmya K S<sup>2</sup>, Rekha Jayaram<sup>3</sup>

<sup>1, 2</sup>B.M.S. College of Engineering, Bengaluru, Karnataka, India <sup>3</sup>Dayananda Sagar College of Engineering, Bengaluru, Karnataka, India

*Abstract*—Computer Networks and Security is a subject which has more applications in various field. Understanding this subject requires more practical exposure. Problem Based Learning (PBL) is new pedagogical approach chosen to teach and make the concepts understandable with required real time practical problems. To implement PBL, students were very much aware of the concepts in the syllabus with the help of TPS activity and then students were driven smoothly to the PBL activity. Hence PBL has proven to yield good results in terms of understanding the concepts among student communitywith better self-study projects with animations of the expected outcome.

#### Index Terms—CNS, PBL, TPS

#### I. INTRODUCTION

• Omputer networks is a technology to share the information among the computers which are interconnected. This technology is used by not only IT companies but also educational institutions. The information which is shared among users are files, passwords, account numbers, card numbers. Computer networks and security (CNS) is needed to protect the networks from outside world as it is connected to the internet. Teaching this subject is challenging task for the faculty as it involves not only theoretical knowledge but also thorough understanding of the practical concepts. The subject has protocols like TCP, UDP, SMTP,etc. which needs more practical exposure. When the data has to transmitted across untrusted networks [1], security has to be taken care with higher priority. Recently many techniques such as encryption algorithms, trusted network for sending the data and reliable people to maintain the database are employed to safeguard the data. Information security is not only enough to protect the data but it is also required to take care about who should access the data. Only authorized users should be able to access the data. It is the job of the network administrators to set the proper access privileges to the users. Computer Networks and security plays an important role internets as well as internets. Security has to be given more attention in different premises like colleges, corporate, schools, government offices and business organizations. All the organizations has to take care of security features like authentication, authorization and privacy. It is difficult for faculty to convince the student only theoretically hence

laboratory and Problem Based Learning approach is integrated into the subject.

#### Types of threats

Different types of threats are found in the networks especially when user connects to the internet [4]. The threats can be classified in to

Active attacks: These attacks are posed from an unauthorized user and alter the information to be delivered to the destination.

**Passive attacks:** Attacks by which attacker gains the information by eves dropping between the sender and receiver.

# II. PROBLEM BASED LEARNING (PBL)

PBL approach provides students to apply theoretical concepts in enhancing the level of learning to a larger extent.PBL is paradigm shift from traditional teaching method to active learning method. Students are exposed to real life problems [2] and make an analysis to find the solution using modern tools. Computer Networks and Security is used in application scenarios such as business firms, educational Institutions and IT industries. Technology is updating in a faster pace with the introduction of novel applications and protocols. In order to face the new challenges arising in day to day life, it is required to equip our network with latest securing techniques. Teaching the computer networks needs more of practical exposure along with theory. With PBL approach each student will actively contribute towards learning of computer networks and security through knowledge exchange among themselves. Students are given the opportunity of solving problems. Using the PBL approach currently shows improvement over the previous teaching approach.

Many researchers have proved that student centric learning [3] has shown more effectiveness. Group of students in two three in number can form a team and in problem based approach in which all the participants are given with the some task and asked to execute the task. In order to complete the task prior learning is required. This problem based approaches are mostly seen in many scenarios like competitions. The approach is very useful in drawing attentions from many students who are interested in doing practical research rather

than theoretical studies and who are interested in getting rewards. This problem based approach is really helpful for few students who feel difficulty in understanding theoretical concepts unless they work on it.

# III. ADVANTAGES OF PBL

PBL enhances design and create level knowledge in computer network and security among students. Creating awareness among budding engineers regarding security threats and latest trends in computer networks.

The advantages of PBL among students are [7]:

- PBL is more student involved approach.
- Created interest among the students.
- Increase the level of Understanding.
- PBL builds more capabilities among students.
- It is an active learning technique.
- Students develops interpersonal skills.
- Each student gets an opportunity to contribute equally.

The advantages of PBL among Faculty:

- Attentiveness of student in the class increases.
- Students are encouraged to learn more through video lectures, discussion with peers and faculty.
- Builds multidisciplinary interests.

#### IV. IMPLEMENTATION OF PBL

To start PBL approach, students should be very much aware of the concepts taught in the class. As a provision, all the lectures classes were captured using IMPARTUS Lecture Capture tool, which will capture all live sessions and provide them to the entire batch. Hence, student whenever a doubt pops, can listen to the lecture sessions delivered by the faculty.

Also to make the concepts more understandable, Think Pair Share(TPS) activity were conducted in the classes. Questions were posed to the class and each pair of students should give their answers. Winners will be rewarded with small gifts to motivate them to answer first for the next TPS activity

PBL implementation starts with the collection of the questions, learning the subject with active learning techniques, Analysis of Problems in two phases and Evaluation of problem. Entire PBL sessions completes within a semester. For the phase-I, two weeks of duration was given to come up with requirements of the problem and present using the PowerPoint presentation/ Animation tools like POWTOON. For the Phase-II, one month of duration was allotted to complete the design and create the solution for the problem assigned to them. The main objective is to make students

understand real scenarios of IT industries and security advancements currently [5].

# Creation of Question Pool

Question pool has been created with the help of various contributors. A Pool of 30 questions is prepared for both A & B section students. Contributors comprises of the following:

- Students
- Faculty who have handled the subject /doing research in this field
- Faculty from other colleges
- Various sources on an internet such as tutorials, research papers, etc.

Learning Computer Networks and Security with active learning Approach

Computer networks and security is a comprehensive course which was organized with 3 hours of teaching and 2 hours of lab session and 1 hr of PBL session. The course was taught with black board in the classroom along with video lectures. Students were given the taught with concepts which were implemented in the labs. After thorough understanding, students were instructed to design the solutions for the problems. Active learning techniques like think pair Share, flipped class room was used as a part of course.

# Analysis of Problems

Problem Based Learning was the approach chosen to create the awareness .PBL was allotted with 15 marks with two phases as shown in the Figure 1



Figure 1 Implementation of PBL

PBL can be implemented and evaluated in two phases.

Phase I: Content Development relevant to the problem statement

Understanding the problem and able to present the requirement specification to achieve the expected output. Students were given the instruction of framing two or three members per group. For this phase 4 marks was allotted to the students. Students were instructed to give presentation after complete study of requirements such software's and any hardware devices if required.

Phase II: Implementation and Demonstration

Phase II was allotted with 11 marks for the following parameters:

- Design and Implementation of module which yields the expected output.
- Provide a demonstration.
- Write a report.

# Evaluation of Problems

Each student is assessed for the above mentioned marks for two phases through Periodic interaction Sessions. Status of the module implementation was taken every fort night. Inputs from Contributors were considered during these periodic sessions.

The parameters set for the first phase Content Development relevant to the problem statement were

- Logical interpretation of the problem
- Identify appropriate data structures using prerequisite knowledge
- Identify appropriate Programming Language and/or simulation tool
- Use of animation tool/ PPT for presentation

The parameters set for the Second phase which is implementation and demonstration were

- Recognize the appropriate design strategy for the given problem.
- Usage of modern tools and technologies.
- Justification of the design strategy chosen.
- Provide sequence flow diagrams.
- Provide the source code using simple coding constructs which satisfies the requirements and provides the expected output.
- Provide the source code using advanced coding constructs which satisfies the requirements and provides the expected output.
- Derive appropriate conclusions.
- Presentation & Coordination among the team members.
- Response in Question answer sessions.

At the end of two phases the students were supposed submit complete report the comments of the problem assigned to them.

# V. OUTCOMES OF PBL APPROACH

The Outcomes of PBL approach are listed as follows [6]

• Leads faculty to meet the attainment of graduate attributes:

Students will be able to understand, process and apply the knowledge of computer networks and security accordingly to the problem given. PBL gives scope to students to analyze the real world problems in a group. This combination leads the faculty to achieve the graduate attributes like designing the solution to the problem, communicate effectively as a team member.

- Students gets exposure to various real world problems.
  Students will get more exposure to real ongoing scenarios. This will lead to improve student's interest in learning the subject.
- Student gets hands on experience while learning theoretical concepts. Theoretical concepts will be clearer as they are applying concepts to solve different problems.
- Student's ability to design and create the solution for the problems is enhanced.
  Level of understanding will be higher as student will be designing and creating solutions for the problems.
- Student will able work as a team member and also develops the leadership skills if required. As the student is allowed to work in group, it is noticed that student will be able to work in a cooperative manner and takes the role of leader if required. Students can exchange the knowledge in a group in order to tackle the problem.
- Written communication skills of the student will be improved.
  Students were asked to submit a complete report of problems implemented with requirements, analysis and design methodology.
- Students develop lifelong learning skills. Students will be benefited with learning ability throughout the life which will contribute to their personal and professional development.

# VI. CONCLUSION

Computer networks and security course which is taught with the PBL approach has shown increased interest among the students. Faculty were able to teach the concepts with active involvement of students in the course. Students worked together in a group of two/three cooperatively as team member. Students were able find the solutions to the problem through discussions among the group members. Students were made access to modern tools to generate animations, to code and to test the software they have developed. Hence PBL approach can be considered as a best practice to teach subjects like CNS.

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