A Blended Approach for Teaching Laboratory Course: Internet Technology

Ms. Varsha T. Lokare¹, Ms. Iram Jhetam ², Dr. A. W. Kiwelekar ³, Dr. L. D. Netak ⁴
¹Computer Science & Engineering, Rajarambapu Institute of Technology, Sakharale.
²³ Computer Engineering, Dr. Babasaheb Ambedkar Technological University, Lonere, Raigad.
varsha.lokare@ritindia.edu
irimjhetam@dbatu.ac.in
awl@dbatu.ac.in
ldnetak@yahoo.com

Abstract: Teaching laboratory courses is a challenging task as compared to teaching theory courses. From a teacher’s perspective, it is a challenging task because he must be able to engage student actively for two hours. From a student perspective, it is challenging because students need to work themselves on machines or other equipment's to find out the solution which actually works for a particular problem. Four laboratory courses, students must be able to apply their past theory knowledge and skills for figuring out desired solution. So the lab course is beyond theory course.

But as a hand on experience is necessary for understanding of the associated theory concepts, it is inevitable. Also in conventional mode of teaching laboratory course where experiment list is predefined by the instructor, the student is passively involved in experimental work. This paper reveals how two pedagogic paradigms, namely Project Based Learning and Collaborative Learning are applied to the Internet Technology Laboratory course and shows how a student attains greater course outcomes than conventional methods used for teaching laboratory course. Project based learning gives better understanding of the concept because student learns by self-exploring and actually doing. On the other hand, in collaborative learning students work collectively in groups to deduce an answer to common problems.

The Internet, Technology Laboratory course is basically designed for understanding the terminologies related to internet protocols at application, routing and transport layers. It is challenging task to motivate students to design and develop all such applications. Hence, collaborative approach has been applied for enhancing the knowledge of the students related to this course by developing application layer protocols in a group. Also the commercial project design technique is used to solve real time problems of customers by designing websites. The student showed keen interest in understanding the customer needs and design the website for them. The analysis shows that there is an average increase of 15% to 20% in course outcome attainment when this blended approach is applied.

Keywords: Internet Technology Laboratory; Project Based Learning; Collaborative Learning.

I. Introduction

Laboratory courses are equally important as student gets machine experience of the concept which is taught to him in the class. This leads to deeper understanding of concepts and building robust technical skills. In conventional mode of teaching an instructor finds difficult to motivate student and engage them actively for the entire session. Hence, to create interest among the students about the Internet Technology Laboratory course (ITL), collaborative
learning during lab hours has been applied that helped a lot in terms of student engagement and hands on experimentation. Also, with Project Based Learning approach enhanced the student's ability to deal with real clients in understanding the requirements to build commercial web sites. Figure no. 1 shows two methods applied while teaching the Internet Technology course:

1. Project based Learning (PBL): To develop a commercial website

2. Collaborative Learning (CL): To perform various application layer protocol designs in a group during lab hours.

The ITL course mainly focuses on the design and development of the application layer protocols like FTP, DNS, etc. The collaborative learning approach will help in this regard as there is a need of demonstrating this activity in client-server architecture design.

2. Application layer protocol: HTTP design is associated with PBL approach in which students have to design and host website for commercial purpose.

3. Design of application oriented servers like FTP, DNS, etc. need to be demonstrated in client server modelling.

4. Design and testing of Audio video streaming protocols in a group of 2/3 students.

5. Routing Protocol analysis using NS-2 simulators in a group.

Following are the course outcomes (COs) of this course:

1. To design and implement socket programming by using
   C/Java OR Python language

2. To develop and host website for commercial purpose

3. To build application oriented servers like FTP, DNS etc.

4. To demonstrate audio/video streaming

5. To analyse routing protocols using the NS-2 Network Simulator.

Hence, to assess this laboratory course traditional approach will not work there is need of some innovative methodologies that can evaluate students in groups. To achieve above mentioned course outcomes different innovative teaching, learning methodologies has been applied, like for CO2 project based approach, CO1 and CO3: Collaborative Learning and CO4 and CO5: Demonstration. Here in this paper, two approaches (PBL and CL) are discussed in the next two sections.

Comparative analysis, of course outcomes attainment of this course did in the last section.

2. Literature Review

Project based learning is a student centric learning approach in which a student learns by actually solving real world problems by himself. It not only enhances technical qualities of the student, but also improves decision making and thought process. This approach
3. Project Based Learning

As ITL course is more practical oriented, project design approach is best suitable for understanding of the course. PBL approach prepares students to solve real world challenges/problems by providing technology based solutions. Hence in the process of teaching-learning of the ITL course, students were met real time stakeholders, list out the requirements and specifications, discuss on the consultancy amount and finally host the website as per client requirements.

A) Objectives:

1. To motivate students to deal with real clients
2. To design and develop websites

B) Outcomes:

1. To understand the Web, designing concept by developing a project.
2. To design website for commercial use.

C) Activity Plan:

The teacher tells students to form groups of 3 to 4 students by their choice.

1. Each group visit to nearby shops like medical store, parlour, gas suppliers, bakery stores, jewellers etc. and collect their requirements for designing websites.
2. Convince client to pay money if possible.
3. Collect all information and submit to faculty with signed document on the client.
4. Design the website
5. Demonstrate project in front of the client and make modifications if any, and submit reports to the faculty. (Once or twice in a month)
6. Submit a report of customer satisfaction to the faculty.
7. Demonstrate project in front of faculty.

List of projects designed by the students is mentioned in Table 2. This work was evaluated on the basis of rubrics defined in Table 1.

Table 1 list out the parameters under which website design project has been evaluated. Dimensions are also categorized as per the task completed, specified marks were allocated. Table 3 list out the details of the groups and respective website design project description. Few group members have also generated consultancy amount through their project design. All groups have an outsourced code of their projects on GitHub. Each group submitted Feedback from duly signed by the respective owner/client. It has been observed that many real world stakeholders like restaurant owners, government sectors, private sectors NGOs etc. has been addressed by many PBL groups.

Table 1 list out the parameters under which website
Table 1: Rubrics to evaluate PBL.

| Criteria | Dimensions |
|----------|------------|
| Poor (Marks: 0 to 1) | Fair (Marks: 2 to 5) | Good (Marks: 6 to 7) | Excellent (Marks: 8 to 10) | Total |
| Code validity, code readability, cleanliness of folder structure. | The submission's coding (and code presented in the style guide) is not human readable, nor valid HTML5 and CSS3 with up to 4 major errors (things we have taught you directly) and up to 6 minor errors. There are some major concerns with the cleanliness of the file and folder structure. | The submission's coding (and code presented in the style guide) is human readable, valid HTML5 and CSS3 with 1 major error (things we have taught you directly) and up to 4 minor errors. There are some minor concerns with the cleanliness of the file and folder structure. | The submission's coding (and code presented in the style guide) is human readable, semantic and valid HTML5 and CSS3 with up to 4 minor errors (things we have not taught you). File and folder structure is clean. | The submission's coding (and code presented in the style guide) is human readable, semantic and valid HTML5 and CSS3 with absolutely no errors. CSS uses a meaningful naming convention, and file-folder structure is clean. |
| Design: Consistency, interface and interaction elements. | The style guide presents an inconsistent aesthetic with unclear interface and interaction cues that respond poorly to user interactions. Little to no connections are built in the final sketches/wireframes, hindering our understanding of navigability significantly. | The style guide presents fairly consistent aesthetic with some unclear interface and interaction cues that respond somewhat effectively to user interactions. The final sketches/wireframes show how navigation will occur, though the structure of the site and navigation is unclear at times. | The style guide presents a consistent aesthetic with clear interface and interaction elements that effectively respond to user interactions. The final sketches/wireframes demonstrate an understandable model of the site's structure. | Effectively leverages principles of 'atomic design' to construct combinations of elements (i.e. navigation, product/service listing) that effectively respond to different devices. The final sketches/wireframes help demonstrate how the site will effectively direct the user to move deeper into the site. |
| Deliverables, weekly checks, quantity and quality of exploration. | Numerous weekly deliverables are missing. Some of the required weekly deliverables are missing. | Deliverables meet the expected amount of process exploration outlined in the brief. | Deliverables demonstrate more exploration both in quantity and quality than outlined in the brief. |
| Website Feedback survey by the end user | End user Dissatisfied | End user neutral | End user satisfied | End user very satisfied |

Total 10/40

Table 2: PBL evaluation based on Rubrics sheet

| Criteria | Dimensions |
|----------|------------|
| Code validity, code readability, cleanliness of folder structure. | ✔ |
| Design: Consistency, interface and interaction elements. | ✔ |
| Deliverables, weekly checks, quantity and quality of exploration. | ✔ |
| Website Feedback survey by the end user | ✔ |

Total 26/ 40

Table 3: Commercial Website Project details

| Group No. | Roll No. | Name of Client | Name of company/Organization | Website Specifications |
|-----------|----------|----------------|-----------------------------|-----------------------|
| 1         | 1403060 , 1503002 , 1503014 , 1503055 | Sanjay Bhosale | Hotel Maharaja | Creative Design, All the Menu card details, Photos of hotels, dishes, Customer feedback form |
| 2         | 1501056 , 1503009 , 1503013 | R.R.Jadhav | Gandhi Vidhyalaya | Creative Design, Profile with Photo, Photos and information is in good manner, Customer feedback form |
| 3         | 1503008 , 1504014 , 1503017,1503018 | Sanket unane | Shremant hotel | Creative Design, Menu card details, Photos of hotels, chefs, Customer feedback form |
| 4         | 1504040 , 1504048 , 1504063 , 1505053 | Aniruddha Manolikar | Sarthi | Creative interface for both mobile and web, Booking for E-rickshaw, Uber facility in rural and urban areas |
| 5         | 1653003, 1653008, 1653010,1403038 | Manish Bhat | Shree Institute | Creative design and Effective User Interface. Portal to post event information and posters. Gallery includes pictures of already happened events. Facilities. Online registration, login and application. |
| 6         | 1504027,1504029,1504031,1653030  | Sai Patil | Sai Rentals | Effective User Interface. Gallery with car photos and price. Online registration. Login Page |
| 7         | 1653012, 1653011, 1503042, 1504045 | Mt.Vishal Jadhav | Angipankh | Effective User Interface. Gallery with children photos and Donate Page Online registration. Login Page |
| 8         | 1503027, 1503028, 1503022, 1503015 | Mrs. Rekha Bhosale | balkrishna sangle vidyanandir ichalkari | User Interface, Online registration, Login Page, student data adding and deleting |
| 9         | 1503031, 1503053, 1503056, 1503089 | Mrs.Dinesh Jadhav | Bhavyashree Cards | Effective user interface. Order page, gallery with wedding card photos, Menu bar with different religion cards |
| 10        | 1503051 ,1403057 , 1504049 , 1503043 | Shri. Krishanji Jadhav | Jadhav Enterprises | Register, User to system, Login/logout features, Filter out cars according to user, requirement, Show details of each car |
design project has been evaluated. Dimensions are also categorized as per the task completed, specified marks were allocated. Table 3 list out the details of the groups and respective website design project description. Few group members have also generated consultancy amount through their project design. All groups have an outsourced code of their projects on GitHub. Each group submitted Feedback from duly signed by the respective owner / client. It has been observed that many real world stakeholders like restaurant owners, government sectors, private sectors NGOs etc. has been addressed by many PBL groups.

D] PBL Evaluation: To assess groups mentioned in Table2, rubrics defined in Table1 are considered. As per the criteria's mentioned in Table1 marks are given. Sample evaluation sheet as shown in Table2 has been designed and used for the assessment of PBL activity. Total four criteria's were defined, namely related to code validity, code design, weekly checks and end user feedback. Total four dimensions have been considered: poor, fair, good and excellent.

As per the ranges mentioned per dimension, marks were given to the students out of 40. In the evaluation procedure of ITL course total 100 marks are allocated as per mentioned below:

1. In Semester Evaluation1 (ISE1) = 10 marks
2. In Semester Evaluation2 (ISE2) = 10 marks
3. Continuous Assessment Sheet (CAS) =30marks
4. End Semester Evaluation=50 marks

Also, the weekly checks concept has been applied in PBL, which contains following points:

a. Task completed till date
b. Modifications/suggestions in completing tasks by the client
c. New task assigned by the client along with a deadline
d. Duly signed a paper with signature of the client

PBL evaluation is associated with ISE2 examination. Hence marks obtained out of 40 as per PBL evaluation rubrics were finally converted into 10. This evaluation strategy is applied to assess all the groups.

3. Collaborative Learning

In ITL course, hands on sessions are carried out to learn the terminologies like socket programming, client and server etc. Hence, the task is divided among the group of 2/3 students and the group need to demonstrate the client server model for giving application.

A] Objectives:

1. To understand the working of client server architecture with hands on.
2. To design and develop application oriented servers

B] Outcomes:

1. To implement the client server architecture in a group of students
2. To understand application oriented servers by hands on Coding in a group.

C] Activity Plan:

1. Tell students to work in a group of three and one must act as a server and remaining 2 as a client's (as per their choice)
2. Discuss the server and client code in a group
3. Execute client server architecture for giving problem statement
As per the individual experiment requirements along with mentioned rubrics few associated rules were defined.

Example: Experiment no. 1 evaluation as per rubrics:

Expt1: Design client server architecture to check the entered number is strong number or not.

Following assessment rules has been considered along with defined rubrics:

a. Successful connection between client and server machine
b. Client sends an integer number to the server
c. Server machine processes the code written at the server end to check received integer number is strong or not.
d. Server sends results back to the client i.e. “number is strong” or “number is not strong”.

Expt.6: FTP server creation

Following assessment rules has been considered along with defined rubrics for this experiment:

### D) CL Evaluation

It is easy to evaluate individual student based on task completion, but in group task assignment, it is difficult to keep track of the individual group member contribution, some protocols need to be defined in the evaluation. Hence, to evaluate this group activity, rubrics were designed as shown in Table 4 and sample assessment sheet of CL evaluation is as shown in Table 5.

Following four criteria’s were considered for the group evaluation:

1. Ability to demonstrate the program in groups: students must be able to demonstrate the code.
2. Ability to run /debug on different platforms: Able to run on Linux as well as Windows Operating System.
3. Ability to perform input validation: Code must be worked on all types of inputs
4. Ability to produce readable programs: Program must be readable and easy to understand.

Along with this total five dimensions were considered, namely very poor, poor, Fair, good and excellent. Marks a range for each dimension is predefined.

As per the individual experiment requirements along with mentioned rubrics few associated rules were defined.

Example: Experiment no. 1 evaluation as per rubrics:

Expt1: Design client server architecture to check the entered number is strong number or not.

Following assessment rules has been considered along with defined rubrics:

a. Successful connection between client and server machine
b. Client sends an integer number to the server
c. Server machine processes the code written at the server end to check received integer number is strong or not.
d. Server sends results back to the client i.e. “number is strong” or “number is not strong”.

Expt.6: FTP server creation

Following assessment rules has been considered along with defined rubrics for this experiment:

| Criteria                              | Dimensions                  | Total |
|---------------------------------------|-----------------------------|-------|
| Ability to demonstrate program in groups | Unable to Explain program design |     |
| Ability to run /debug on different platforms | Unable to run program but have logic error |     |
| Ability to perform input validation | The program produces incorrect results |     |
| Ability to produce readable programs  | No Documentation            |     |

### Table 4: Rubrics to evaluate CL

| Criteria                              | Dimensions                  | Total |
|---------------------------------------|-----------------------------|-------|
| Ability to demonstrate program in groups | Unable to Explain program design |     |
| Ability to run /debug on different platforms | Unable to run program but have logic error |     |
| Ability to perform input validation | The program produces correct results but does Not display Correctly Does not check for Errors and Out of-Range data |     |
| Ability to produce readable programs  | No Documentation            |     |

As per the individual experiment requirements along with mentioned rubrics few associated rules were defined.

Example: Experiment no. 1 evaluation as per rubrics:

Expt1: Design client server architecture to check the entered number is strong number or not.

Following assessment rules has been considered along with defined rubrics:

a. Successful connection between client and server machine
b. Client sends an integer number to the server
c. Server machine processes the code written at the server end to check received integer number is strong or not.
d. Server sends results back to the client i.e. “number is strong” or “number is not strong”.

Expt.6: FTP server creation

Following assessment rules has been considered along with defined rubrics for this experiment:

| Criteria                              | Dimensions                  | Total |
|---------------------------------------|-----------------------------|-------|
| Ability to demonstrate program in groups | Unable to Explain program design |     |
| Ability to run /debug on different platforms | Unable to run program but have logic error |     |
| Ability to perform input validation | The program produces correct results but does Not display Correctly Does not check for Errors and Out of-Range data |     |
| Ability to produce readable programs  | No Documentation            |     |

### Table 4: Rubrics to evaluate CL

| Criteria                              | Dimensions                  | Total |
|---------------------------------------|-----------------------------|-------|
| Ability to demonstrate program in groups | Unable to Explain program design |     |
| Ability to run /debug on different platforms | Unable to run program but have logic error |     |
| Ability to perform input validation | The program produces correct results but does Not display Correctly Does not check for Errors and Out of-Range data |     |
| Ability to produce readable programs  | No Documentation            |     |
a. FTP server successfully created by the group
b. Client can able to upload data on FTP server
c. Client can able to download data on FTP server

Accordingly the assessment procedure is carried out for the entire batch of 20 students. The whole class of 80 students is divided into total four batches.

4. Experimental Analysis

Total 10 experiments were included in the Internet Technology Lab course, the mapping of each experiment with the respective course outcome (as mentioned in introduction part) is as shown in Table 6. It also shows the teaching, learning methodologies that were applied per experiment. The PBL and CL methodologies had been applied for third year students in academic year 2017-18.

A] CO Attainment Measurement:

To calculate the attainment of each course outcome (mentioned in introduction section) both direct and indirect approaches [10] are applied. The weight allocation for direct method is equal to 80% and for indirect method 20% weight is given.

I) Direct Method:

The ITL course evaluation procedure is explained here by considering sample 10 students marks in various examinations conducted during the semester.

To measure CO attainment mapping of examination with respective CO is need to be input along with the marks of the students.

Steps to evaluate CO1 attainment for the example given in Table7 & Table8:

Step1: Calculate total marks for each exam type $i=\text{Tot}Mi$

Step2: Calculate the average marks for each exam type $\text{Avg}Mi$

Where $i=1$ to $N$ (Number of Examination)

Step3: Identify exam types associated with particular CO. For example ISE1, CAS and ESE exam types are associated with CO1.
Step4: Calculate the sum of Avg marks for ISE1, CAS and ESE exam types (6.3+25.7+35 = 67)

Step5: Calculate the sum of marks for ISE1, CAS and ESE exam types (10+30+50 = 90)

Step6:

\[
\text{CO}\_k\text{Attainment} = \left( \frac{\sum \text{AvgMarks}}{\sum \text{sum of Marks}} \right) \times 100
\]

Associated with particular CO\_k ............eq1

where k =1 to number of COs

Table7: Sample Marks of 10 students

| Roll No | Examination Type |
|---------|------------------|
|         | Programming Test(ISE1) | PBL (ISE2) | CAS | ESE |
| Marks-> | 10 | 10 | 30 | 50 |
| R1      | 8 | 8 | 22 | 39 |
| R2      | 5 | 7 | 18 | 25 |
| R3      | 6 | 7 | 22 | 32 |
| R4      | 4 | 6 | 21 | 28 |
| R5      | 10 | 7 | 28 | 43 |
| R6      | 9 | 8 | 29 | 45 |
| R7      | 8 | 9 | 27 | 41 |
| R8      | 6 | 9 | 21 | 40 |
| R9      | 3 | 6 | 19 | 31 |
| R10     | 4 | 7 | 20 | 26 |
| Total Marks | 63 | 74 | 257 | 350 |
| Average Marks | 6.3 | 7.4 | 25.7 | 35 |

Table8: CO Mapping with examination Type

| Course Outcome | Examination Type |
|----------------|------------------|
|                | Programming Test(ISE1) | PBL (ISE2) | CAS | ESE |
| CO1            | ✓ | ✓ |    | ✓ |
| CO2            | ✓ | ✓ |    |    |
| CO3            | ✓ | ✓ |    |    |
| CO4            | ✓ | ✓ |    |    |
| CO5            | ✓ | ✓ |    |    |

Here in this example (67/90)*100=74.44 is the attainment of CO1.

II) Indirect Method:

In this type of the CO attainment calculation method instead of marks secured by students in particular questions associated with any CO, students' feedback is considered. For example consider the below mentioned question associated with CO1:

Q.1) Can you able to design client server programs?

Options: a. Yes b. No

The above question is associated with CO1. If out of 80 students 60 students have chosen Yes and 20 students choose No, then the indirect attainment of CO1 = (\(\sum \text{No of students' type option a} \times 100\)) ÷ Total number of students ............eq2

Here, Total number of students=80

Number of students' type option a =60

Hence CO1 indirect attainment=75%

i.e. (60 *100 / 80)

III) Direct + Indirect Method:

Total 100% distribution is as follows:

A 80 % weight for the direct approach and 20% weight for indirect approach. Hence, here in this sample case Direct CO1 attainment= 74.44% and indirect CO1 attainment=75%. Total CO1 attainment =74%

Similarly, course outcome attainment is measured for all COs. The attainment of each course outcome is measured and analysed with the traditional approach in which the course was taught by conventional manner and the PBL + CL approach as shown in Table 9 and Figure2. It has been observed that as in previous academic years, the course had taught by traditional way, i.e. individual lab assignments were given and students were found it very difficult to complete. In academic year 2017-18, two innovative tools, i.e. PBL and CL were applied and that shows the tremendous increase in the course outcomes attainment.

To measure the attainment of course [11] direct attainment is considered. For experiments that were mapped with CO1, CO3, CO4 and CO5 CL approach had applied. Every CO attainment shows around 15%
to 20% increase as compared to conventional approaches.

Traditional approach of teaching ITL course has been applied to the students of Third year computer engineering at Dr. Babasaheb Ambedkar Technological University, Lonere Raigad in which individual lab experiment allotment and assessment have used. While the same ITL course had been taught by using a PBL+CL approach at Rajarambapu Institute of Technology, Sakharale. The above analysed experimental work was applied to total 160 students, i.e. 80 students from Dr. Babasaheb Ambedkar Technological University, Lonere Raigad and 80 students from Rajarambapu Institute of Technology, Sakharale.

Table 9: Comparative analysis of Course Outcome

| Course Outcome (CO) | Course Outcomes Attainment (In %) |
|---------------------|----------------------------------|
|                     | Traditional Approach              | PBL + CL Approach              |
| CO1                 | 60.13                            | 77.23                          |
| CO2                 | 67.05                            | 80.43                          |
| CO3                 | 58.3                             | 78.15                          |
| CO4                 | 56.5                             | 79                             |
| CO5                 | 40.5                             | 67.06                          |

Also, the feedback related to PBL and CL teaching, learning methodologies had taken on the scale of 0 to 10 i.e. individual students need to give mark to the activities PBL and CL in the range 0 to 10. It is observed that the 84% students has given 9 to 10 marks to CL activity and 56% students given 10 marks to PBL activity. 10% students have given below 5 marks to PBL activity and 12% students has assign below 5 marks to CL activity. From the above statistics, we can say that the CL activity is appreciated by most of the students as compared to PBL.

Hence there is need to do some modifications in PBL activities like to provide options in PBL activity. Here in this course total two below mentioned options can be provided:

1. Commercial Website Design

2. Multimedia Application Design

So, the group of students who will not able to get the clients for commercial website design can create any multimedia application for different stakeholders like to create multimedia applications for primary school students for a better understanding of mathematical operations etc. or design multimedia application for any critical topic that may help in better understanding the concept.

It has been observed that there are many hurdles in this entire process like students can't able to find the stakeholder; students were not able to complete the assigned task within the deadline or consultancy amount not paid by the client even with successful completion of the project. So, there is a need to come to some solution to tackle such type of run time situations. In successful execution of the entire process many things are important like student's sincerity, the teacher's role, stakeholder's role, run time environment, etc. Also there are many hurdles in the implementation of CL activity such as few students were reluctant to participate hence here teachers' role is very much important. The teacher need to motivate students so that all students should participate actively along with this strict monitoring and question answer inferring also help in the entire process.

In short, we can summarize the things as below:

1. For successful completion of any innovative teaching, learning activity, proper planning is needed.
2. The teacher should act as an instructor instead of leading the class.
3. The teacher should ensure 100% involvement of the students in the activity.
4. Activity assessment as per defined rubrics may reduce the conflict in marking scheme.

5. The collaborative learning approach will result in better understanding of the course.

6. Project-based learning approach enhances the skill of dealing with real-time stakeholders.

7. Feedback regarding every activity is needed to be collected for further improvement plan.

8. Analysis of the result will tell about the impact of the applied methodologies.

9. Innovative methods may or may not work, the experience is important to plan the course accordingly.

**Conclusion**

Traditional teaching, learning technique is not suitable for many laboratory courses, especially the courses that need to design some client-server architecture. In today's era of internet, all types of information are easily available on the internet so as a teacher one needs to plan laboratory courses in such a way that the student learning can take place by working in groups. Hence, the CL approach had applied that result in a tremendous increase in the understanding of the students. This approach also enhances the other qualities among the students like group discussion, leadership, etc. The PBL approach helped students to apply the things taught in the course to solve real-time problems, i.e. students need to visit nearby stakeholders and convince the clients for giving project that enhances the skill of dealing with real-time clients. Also, it increases the confidence among the students about working with real project. Hence the experiences of handling real-world projects can get through the entire process. Students also need to encourage the stakeholders about the consultancy amount of the project. So, students can understand about calculating the amount of project done and can able to convince the client for the same.

To teach The Internet, Technology Laboratory course two methodologies are applied, namely Project based Learning (PBL) and Collaborative Learning (CL). It has been observed by result analysis that there is an increase in the percentage of every course outcome of around 15% to 20%. Hence, the applied methodologies were succeeded in enhancing the student learning capacity.

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