Development of ICT Based PBL Platform

Mrs. C.M.Pandit[1], Mrs. B.R.Panpat[2]

[1]Computer Engg, ViMEET,Khalapur
[2]Computer Engg, ViMEET,Khalapur
[1]charusheelapandit@gmail.com
[2]brpanpat@vishwaniketan.edu.in

Abstract: Since Vishwaniketan's Institute of Management Entrepreneurship and Engineering Technology (ViMEET) is affiliated to Mumbai University, it has to follow the traditional teaching learning methodology. Daily routine of typical classroom teaching and feeling of unworthiness for few courses makes learning process boring and irritating for students. But following PBL practices along with traditional teaching learning methodology can add spice to the professional life of teachers and students. Though, PBL is innovative tool for teaching and learning process, but following the practices of traditional teaching learning methodology along with PBL approach increases workload on teachers and students. Maintaining the details of all PBL activities manually can be a cumbersome process for teachers. In such case integration of ICT to PBL can be a great help. So far participation of ICT in PBL is in online learning, online feedback, for assignment submission etc. This paper proposes the architecture of web based tool which automates PBL activities and makes it paperless. This tool is first of its kind in the institution and in whole Mumbai University.

Keywords: PBL, ICT

1. Introduction

In traditional classroom teaching, students are completely dependent on teachers in every study related matter. Due to this spoon feeding students hinder creativity in them and become handicapped in critical thinking. In traditional education system it is impossible to maintain work life balance and it make students jack-of-all and master of none. Sometimes routine activities makes learning process very boring and frustrating, due to which students lose their interest in education and their passion about work and career. Project Based Learning (PBL) is the answer to every limitation of typical classroom teaching.

Project Based Learning (PBL) is very powerful and innovative teaching learning tool. Project Based Learning (PBL) assists to improve the quality of education, employability of students and give more practical approach to teaching and learning method. It is a influential teaching learning tool with many benefits, like it prepare students for critical thinking, problem solving, project management, collaboration. It also improves interpersonal skills in students, increases their creativity, determines actual depth of knowledge in students and teachers, technology inclusion and many more. Looking towards its inestimable benefits of Project Based Learning (PBL), Vishwaniketan's Institute of Management Entrepreneurship and Engineering Technology (ViMEET) is following PBL approach along with traditional teaching learning methodology. Selecting PBL approach means changing the culture of traditional teaching learning approach.

In Project Based Learning, teaching and learning is through project. Students select projects either from the list provided by faculties or of their choice and form their project groups. Formation of project groups and project selection is always a chaotic process. Faculties has to keep track whether all students has enroll for PBL or not. Faculty also has to monitor whether same project is not been selected by multiple project groups. Many times students keep changing projects and their project groups depending upon their relations with other friends in their own group or sometimes in other group. Situation become worsen when students don't follow the deadline of project selection and project group formation. It becomes time consuming and hectic process to run behind the students who are lagging in submitting their project name and project group information.

Faculties find it very difficult to maintain students' information and their project details manually. Every time they have to check their papers to know whether all students have got project or not. It is very wearisome and tiresome process to analyse the repetition of project titles, to identify number of students who failed to submit their project details and to keep track of project completion status physically. The proposed web based tool ViPBL can definitely answer all above problems which teachers are facing.

ViPBL facilitate students to provide information about project group members, their names, project title, etc online. With the help of the data supplied by students various inferences can be drawn out. Teachers can easily identify how many students has enroll for PBL, How many project groups are created, which group is working on which project, how many project groups are working on same project, how many students have not yet formed group and many more. As ViPBL is web based tool, this information is available 24X7 and teachers can access it anytime and from any corner of the world. Teachers' don't need to contact students personally and ask about project. Teachers can monitor students' performance online and can

motivate them to complete their work on time. This reduces his/her pressure of taking follow up of students' projects in working hours. Design Components are shown in Fig. 1. Few activities mentioned in Deign Components are course specific and few activities are project specific. As faculties are maintaining this information manually for each project group, they have specified this information again and again. This repetitive task consumes their valuable time which makes them annoying and develops dislike about PBL process. To avoid this hassle and to increase the acceptance for PBL, ViPBL has served certain modules where teachers enter this information only once. More explanation is given in Section IV. ViPBL will save the valuable time of teachers which they were wasting in writing same data repeatedly. The technology inclusion in ViPBL will make PBL activities smart and paperless. This will allow teachers to spend quality time with students where students can discuss their project related queries and this will lead to build good student teacher relationship. Students can complete their projects on time and can maintain the quality of projects under the surveillance of their teachers. This will eventually make PBL interesting and lead to huge success of PBL.

The rest of the paper is organized in following manner:

Section II is a CLPBL: Philosophy and Practice, Section III is Related which describes use of ICT in PBL. Architecture of web based tool is explained in section IV. Section V is Future Development and Section VI is Advantages of system and VII is References.

2. CLPBL : Philosophy and Practice

CLPBL is an abbreviation of Course Level Project Based Learning. The main objective of CLPBL is content learning. CLPBL can help to merge PBL activities in traditional teaching learning methodology. Mumbai University is running various under graduate, post graduate and PhD programs. All these programs comprises of many courses/subjects. Syllabus/curriculum and examination structure for all these courses is predefined by the University. All colleges who are affiliated to Mumbai University ought to follow this predefined structure for programs which they are running. Course Learning Objectives (CLOs) are associated with every course, which are predesigned by University. A course learning objective (CLOs) specifies a behaviour, skill or action, the students can demonstrate, if they have achieved mastery of the objective for that particular course. The achievement of these CLOs is to ensure that students have learnt the subject at par. The confirmation for the same can be done with the help of CO-PO attainment matrix which is mapping of course objective with program objectives. The automation of CO-PO matrix is future development of ViPBL.

Students enroll themselves for some program and later realize that learning of some of the courses in the program is total waste of time. These courses have no real time applications. Concepts taught in this subject have no further use. This feeling of unworthiness withdraws their interest in that subject. This later reduces their attendance in the class room, which eventually increases the difficulty level of that subject. This leads to poor performance in examination and less grades.

To change this scenario, to make students realize the importance of subject, Course level PBL (CLPBL) is designed. The faculties who are conducting CLPBL designs real life problem statement, which can be further solved by students with the help of concepts mentioned in the syllabus of that course. Problem statements design by the faculty has peculiar characteristics like, problem statement should be vague, challenging, should not be elaborative and should cover few topics from the syllabus. The purpose of CLPBL is shown in Fig. 1.

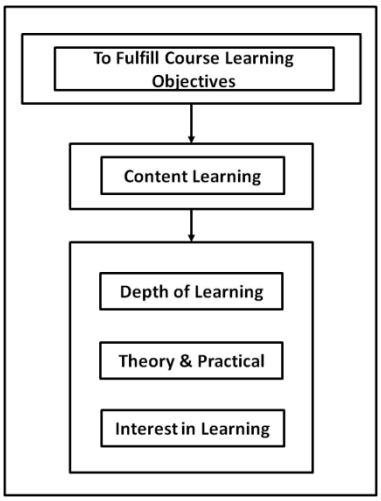

Fig.1 Objective of CLPBL

In ViMEET, to implement CLPBL, one course is selected from each semester for a particular program. Rubrics are designed by the faculty for assessment and evaluation of CLPBL project. The main intention of CLPBL is to fulfil Course Learning Objective (CLO). CLOs can be fulfilled only, if there is a content learning. Content learning is achieved if problem statements designed by faculty satisfy Course Learning Objectives, if not all, but at least few of them. Once the Content Learning is achieved, the depth of learning and knowledge of the students will automatically increase. Thus the knowledge earned by the students can be implemented practically by them. As it is a proven fact that the practically implemented knowledge can be memorized for a longer time, so, this will help students to smoothly prepare & appear for the written exams and improves their grades. This will immensely develop their interest in the subject and will help to improve the attendance in the classroom. Fig. 2 elaborates the step-by-step conduction of CLPBL in ViMEET.

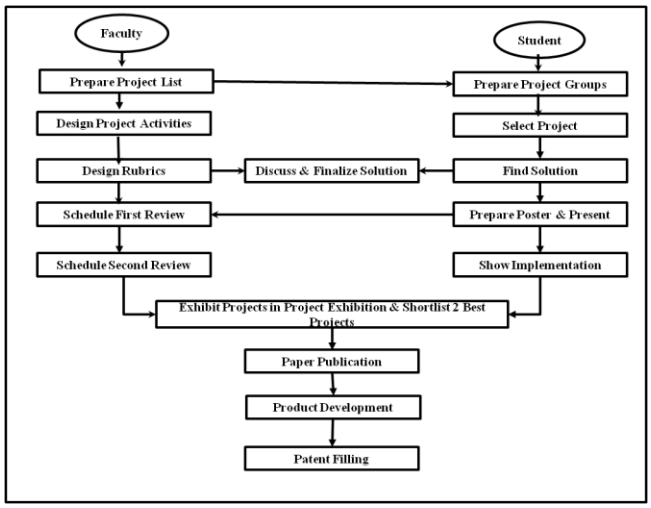

Fig.2 CLPBL: Step-by-Step

There must be some proof that will help to access the effectiveness of CLPBL conduction, quality of the problem statement, students learning out of that project, important topics covered through that project etc. In ViMEET, faculties, who implement CLPBL, answers these questions through CANVAS. The CANVAS is nothing but a document which is maintain by faculties for every CLPBL project group, whose template is shown in Fig. 3(a) and Fig. 3(b).

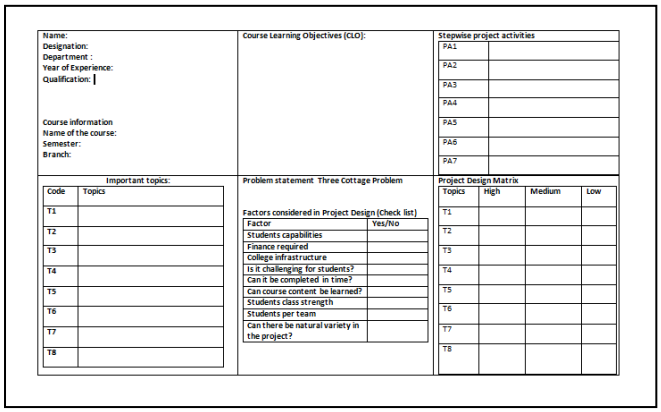

Fig. 3(a) Template of CANVAS

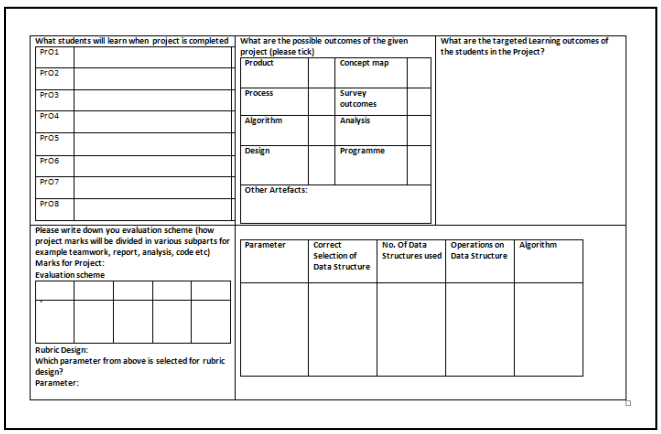

Fig. 3(b) Template of CANVAS

CLOs, evaluation scheme and Rubric design shown in CANVAS template is common for all CLPBL projects. Whereas, stepwise project activities, important topics, project design matrix, possible project outcomes, targeted learning outcomes and students learning from project when it is completed varies from one project to another. All these factors mentioned in fig.4 are considered while designing ViPBL.

The Course Learning Objectives (CLO), evaluation scheme and Rubrics are designed only once at the start of the course and applicable to all the projects of that particular CLPBL. As all projects are developed under that particular course to learn the course content, CLOs are applicable to all projects of CLPBL and so, need to design only once. Rubrics designed are used to assess and evaluate all the projects of CLPBL. As canvas is filled manually, faculties have to mention CLOs and Rubrics on each canvas of project. This repetitive task consumes quality time of faculties which they can use in some productive work. For an individual project, faculty has to specify important topics covered in implementation of CLPBL project, stepwise project activities, project outcomes, what students has learned after the completion of project and the targeted learning outcomes of the students in the project. But when multiple groups selects same project, faculty has to specify all these details in each group's canvas. Though PBL is a very innovative teaching learning tool, it also increases workload of faculty. In addition to this, the repetitive task not only increases the fatigue of faculty but also reduces their faith on PBL.

ViPBL removes the bottleneck in manual system by avoiding repetitive data entry in the CANVAS. ViPBL tool not only relieves faculty from this iterative job but also helps in making these PBL activities interesting and smart. Because of this smart tool, faculty is required to feed the CLOs, evaluation scheme and Rubrics design only once,. Also, the common parameters as explained above for each project are required to be entered by the faculty, only once for each individual project. Along with this, other benefits of ViPBL as explained in Section IV make it a very intelligent and efficient tool to conduct CLPBL.

3. Related work

To conduct PBL activities more efficiently and powerfully ICT plays vital role. PBLAssess uses various modules that provide problems statement, online collaboration, problem solving steps and assessment of project. But tool does not provide the provision for feedback and its analysis module, Rubric design module, project completion status etc.[4] The main purpose of this study is to enhance critical thinking and communication through real time problem solving. ICT tools are used for understanding of course 'Microcontroller Based System Design' using PBL approach. KEIL and CAMU software are used for programming and for assignment submissions. It is observed that ICT based teaching of the course has increased the satisfactory index by considerable margin. [1]

Code Puzzle Android Game is developed with the help of Action Script 2.0, Adobe Flash CS6 to make learning of Programming language interesting for budding programmers using PBL approach. Study reveals that Code Puzzle plays an important role to motivate the beginners to learn programming skills. [2] ICT can be the integral part in learning activities and learning environment to solve real-life problem using PBL approach.[3] This paper studies the effect of ICT assisted PBL practices on ICT integration skills of the 'to be' class room teachers. Here the mixed approach of quantitative and qualitative dimensions has been used for evaluation of the effect. ICT-SEPS and ICT attitude scale used as quantitative data, while interview form was used for qualitative data. Results obtained in the pre and post data collection revealed that ICT assisted PBL practices have positive effects on ICT integration levels for the pre-service teachers.[7] The study through this paper says that PBL with ICT gives better result to improve communication skill over PBL with traditional approach. [10]

Many researchers have used ICT competently to implement PBL practices. Use of various softwares for problem solving, assignment submission, game designing, online collaboration, assessment, to improve communication etc. has made learning process interesting. But it is times need to have all these facilities under one roof where students can also give their feedback about PBL conduction and it should get reviewed. Faculties should able monitor students' performance from any corner of world and any time. This research gap has gave birth to the web based tool ViPBL.

4. Architecture of Proposed System Web Based Tool ViPBL

In ViMEET, the last stage of CLPBL project completion is canvas generation. Canvas is generated for each CLPBL project. Fig. 3 depicts various activities that need to be completed to fill the canvas.

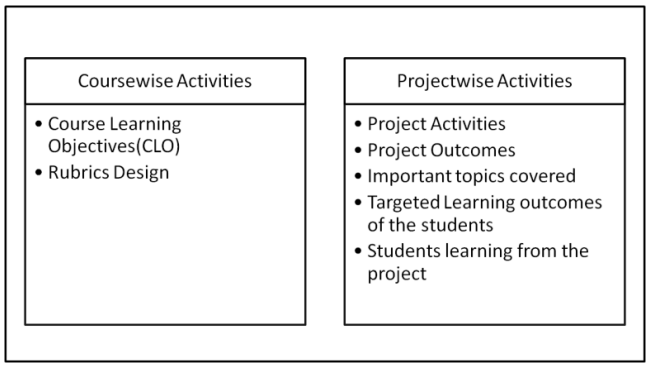

Fig.4 CLPBL Design Components

The proposed architecture of web based tool automates the process of project selection and project group formation, project report submission and evaluation, feedback and the list goes on. This architecture is fortified with various modules which go in line with the canvas. Fig. 5 shows the architecture of web based tool ViPBL.

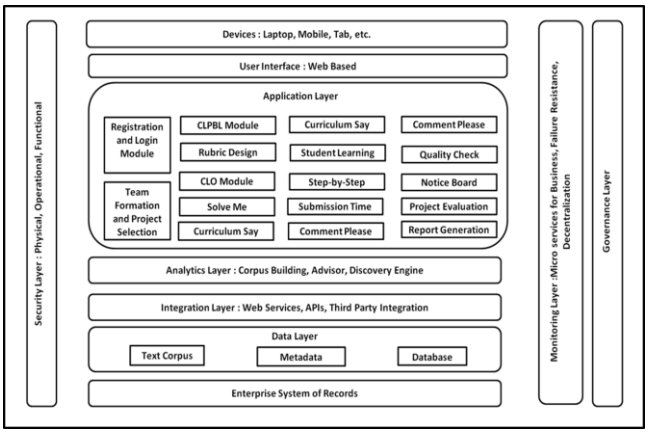

Fig. 5 Logical Architecture of ViPBL (Component View)

The application layer of ViPBL is equipped with various modules that enable faculties to conduct CLPBL more efficiently and with more concentration.

1) *Registration and Login Module*

Registration and login module allows faculties and students to register themselves for CLPBL. Here, the authentication of students' is verified by sending OTP on their mobile phone.

2) *Team Formation and Project Selection*

Students who have registered themselves in *Registration and Login Module* are authorized to provide the details of their project group and the project on which they want work through this module. This module is open to students only when faculties upload their problem statements.

3) *CLPBL Module*

In *CLPBL* module faculty can supply information about his/her CLPBL i.e. course name, year of engineering (e.g SE or TE), semester in which that course is taught, academic year, faculty name etc.

4) *Rubric Design*

Project once is completed, it need to be evaluated. *Rubric Design* module helps faculties to specify various parameters on which projects can be evaluated. Each parameter will be given weightage depending its importance in the evaluation. Faculties can also give the detail bifurcation of weightages of each parameter. This will help students to know on which basis or parameters their work will be evaluated. This will act as guideline for students to produce good quality work.

5) *CLO Module*

Course Learning Objectives of a particular CLPBL are to be mentioned in this module. CLOs, once designed can be later used by all canvases per project group of CLPBL.

6) *Solve Me*

Solve Me is the heart of the CLPBL. It allows faculties to upload the real time problems that can be solved by the students with the help of the concepts they are learning in that specific course.

The information in modules from 1-6 is entered once in the semester and can be used by all canvases. Whereas information in modules from 7-9 is for each individual project. These modules reduce the faculty's time wasted in entering same data in the multiple canvases when same project is selected by multiple groups.

7) *Curriculum Say*

Curriculum Say gives the list of important topics from the curriculum that can be covered for the implementation of the specific project.

8) *Student Learning*

Student Learning module holds the information about what students will learn after the completion of that particular project. E.g. report writing, algorithms, any particular technique or method, communication skill, critical thinking etc.

9) *Step-by-Step*

For efficient project development every project must get divided into various modules, task, sub tasks or activities and all these activities need to be completed into specific sequence. This break down of project is mention in *Step-by-Step* module. Students can take help of this break down and can march towards the successful completion of project in a very organized and planned way. The system is designed in such a way that they have to follow the sequence and deadline otherwise group may get blocked and further process will not be allowed unless otherwise faculty allows them using his/her rights.

10) *Submission Time*

Students not only should complete their work but also should submit it on time. Submission Time provides platform to the students to upload their project status every after 15 days. They can take help project activities mention in *Step-by-Step* module to update on which activity they are working on and how much percentage they have completed. Students can prepare and upload poster before their first review of project. *Submission Time* also enables students to upload their project report after the successful completion of project. This immensely helps faculties to keep track of all the project activities of all the projects and can also monitor the status of project completion. Faculties can check the project status and can motivate the students if they are lagging in ensuing the deadline that too from anywhere and anytime. This reduces her pressure of taking follow up of students' projects in working hours.

11) *Comment Please*

Comment Please gives liberty to the students to express their views about CLPBL, about the quality of problems statement given to them, about the overall conduction of CLPBL, faculty's technical competence, faculty's cooperation, their satisfaction and many more.

12) *Quality Check*

Quality Check is an analytical module. The feedback received from students in 'Comment Please' module is analysed to measure the quality of CLPBL conducted by the faculty.

13) *Notice Board*

Notice Board is used by faculties who are involved in conduction of CLPBL to broad cast the notice, message or submission dates.

14) *Project Evaluation*

Project Evaluation module allows faculties to award marks to students' projects on the basis of Rubrics specified in *Rubric Design* Module.

15) *Report Generation*

A Report Generation module engenders many reports with the help of the data entered all above modules. Feedback report is generated with the help of feedback submitted by students in *Comment Please* module. Project status report can be created on the basis of information mentioned in *Submission Time* module, Faculty will get list of enrolled students from the data entered in *Registration and Login Module*, individual student's grade report and Statement of marks of all enrolled students can be created with help of data feeded by faculty in *Project Evaluation* module. CANVAS is the consolidated report generated for each project group with the help of data entered in each module.

5. Future Development

A. Library Module

In typical classroom teaching, teachers and books are only the resources available to students for learning. Through *Library Module*, web link, e-book, articles, videos, pdfs can be made available for the students through ViPBL.

B. Chat Room

In a city like Mumbai, due to long distance, students cannot find suitable time and location for face to face discussion with their peer teams and mentors. This bottleneck can be solved using *Chat Room*. In *Chat Room*, student can communicate with their team members and mentors. They can share their ideas, discuss queries, seek guidance and can co-operate each other.

C. CO-PO attainment Matrix

To analyse the quality of student learning, *CO-PO attainment Matrix* is used. This Matrix is a mathematical model which supports innovation, helps in continuous evaluation, NBA Accreditation and self assessment report generation.

6. Advantages of System

There are many advantages of ViPBL. Due to ViPBL, student information, along with their project title and project group is available online. Teachers can have 24X7-surveillance on students' project completion activities. Teachers can control and monitor the allocation of same project to multiple groups. Students have platform to give their feedback on CLPBL which will help to understand the quality of CLPBL. It provides provision for online assessment and evaluation of Projects. Students can submit project report, posters and project completion progress in every 15 days. ViPBL make system paperless and saves teachers' valuable time wasted due repetitive data entry.

The architecture of ViPBL has been tested and verified by exerts. The web tool is under development and will get completed soon. It is first of its kind in the institution and in whole Mumbai University. This dedicated web based tool will help in increasing the effectiveness of PBL. It will help teachers to control project activities. Students will experience the automation in PBL with latest technology. It eventually softens the process of PBL and reduces the workload of teachers.

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