

# Innovative Teaching to Improve the Learning Process: An Experience

Karuna C. Gull

Dep. of CSE

K.L.E. Institute of Technology  
Hubballi, India

Ravi Hosamani

Dep. of ECE

K.L.E. Institute of Technology  
Hubballi, India

Susen Naik

Dept. of CSE

K.L.E. Institute of Technology  
Hubballi, India

**Abstract** — Generally, affiliated colleges face several challenges to teach any course designed by the universities. To enlist a few of them are –no freedom to do modifications in the course, a lot of focus is given to the theoretical knowledge, faculty focuses on teaching and learning methods instructed by affiliated University, time bounding (number of hours allotted to complete the course) that results in less freedom & time to adapt new techniques to teach and assess the course to attain its objectives, expecting quick support from the management for additional infrastructure is also hurdle sometime, and many more. To address few of above written challenges and improve the quality of learning process and make learning as a pleasant experience, we suggest to adopt some components as a part of teaching methods like Think share pair, Inculcation of Group activity, Problem definition and analysis, Hands-on process to learn a few concepts, Poster presentation, Student feedback, Exhibitions, Application of new technology in teaching, and many more.

Thus keeping improvisation of learning process as the motto, we make an attempt by taking some courses as cases and demonstrate the learning process with assessment. To make some courses a pleasant learning experience, adopting certain pedagogies like module-wise quizzes, assigning team activity on some of the theoretical concepts, giving field work to groups, facilitating students for poster presentation and exhibitions, assigning the real world simple problems or open ended problems and a scheme that facilitates to assess student's understanding. These attempts have improved the student learning process and helped them in laying a solid foundation to learn theory courses. The paper narrates the experience of the authors.

**Keywords** — Course Outcomes (COs), Curriculum, Assessment, Learning objectives, Data structures and Application (DSA), Semester End Examination (SEE).

## I. INTRODUCTION

Education is a primary factor in everyone's life. Education systems have been increasing rapidly over the years. Education system in Indian is tested for knowledge and intelligence at each level. It is very important to get the innovative and creative teaching learning processes for the advancements of technology. Earlier, the professor would give long lecture in the hall which was a one way communication and students would quietly listen to the professor which would end up being a boring lecture.

However now a days all these are replaced by innovative e-learning and creativity in the way of teaching and sharing the knowledge. All the concepts in creative learning and e-learning are taught by practical knowledge.

Many subjects like Data Communication (DC), Object Oriented Modeling and Design (OOMD), Storage area Networks (SAN), C-Programming for Problem Solving (CPS) Micro-processor, micro-controller, Basic Electronics and many more, are courses that are studied in Computer Science and Engineering and equivalent branches at Bachelor

and Master Levels. Usually these subjects consist of several classroom sessions, quizzes, assignments, tests and list goes on. Theoretical concepts are presented in class room are usually uninteresting since its a one way communication. However one can observe that these subjects are more of lectures and less of interaction among the students and there is even lack of laboratory sessions in some of the subjects. Some subjects need high level of understanding for the students such as the concepts of assembly instruction set, how the data moves to different address and virtual imagination to the students becomes difficult and also understanding their memory interfacing is a tedious task.

### *Reasons for the lacunae*

Gap between course contents, delivery and assessment

1. Syllabus is not focused from basic to advance.
2. Poor correlation between theory and lab in both curriculum design and implementation.
3. Assessment criterion is not in line with stated objectives of the course both in theory and lab sessions.

These issues are addressed by focusing the curriculum, adopting innovative teaching and learning activities and redesigning assessment methodology inline with the course objectives. Outcome Based Education (OBE) frame work [4] is used for focusing on Curriculum and implementation of teaching process[5].

Researchers think that innovation in teaching process helps to increase the students getting admission in the collage.

### *Curriculum Implementation*

- Lesson plan is written using Blooms Taxonomy
- Topic wise objectives are written that address the different levels of Blooms Taxonomy
- Correlated Theory activities are planned.

The proposed method uses multi-pronged strategy to make the class more interactive and involvement of the students. Innovative Integrating theory courses with interactive sessions in class room, problem solving sessions, role plays, quizzes, online interaction, Virtual Class and relevant case studies to provide practical knowledge on theoretical Concepts of selected courses.

The paper is organized into following sections. Section I discusses on focusing on Curriculum and implementation of teaching processes.

Section II describes Teaching- learning activities

Section III narrates Assessment Methods

Section IV tells about impacts of methodology adopted on students

Section V discusses the Observations and Conclusion.

II. CURRICULUM FOCUS FOR IMPLEMENTAION OF TEACHING PROCESS

Theory course is focused for under graduate Engineering Programme. Curriculum focusing and teaching process implementation takes following framework as shown in Figure 1.

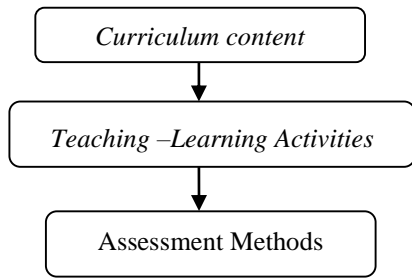


Fig. 1. Implementation of teaching process

A. Curriculum content

For each semester faculty write the lesson plan in advance and hand it over to the students in the beginning of the semester. Lesson plan consists of course contents, course outcomes and topic wise objectives for each chapter. CO's are written using Blooms Taxonomy [3].

B. Teaching-Learning Activities

For every session we have prepared the session plan. Different methodologies used in teaching the course are listed below.

- Chalk & Talk
- Short Movies
- Presentations
- Quizzes
- Tutorials to develop learning practice
- Group Activity
- Exhibition
- Poster Presentation
- Virtual Class
- Assignment
- Workshop & many more

C. Assessment methods

Assessment criteria [1]-[2] are defined to meet the stated objectives in theory. Theory Question papers are designed to address higher level of blooms taxonomy.

The next session details about the contents of the framework shown in figure 1.

III. IMPLEMENTAION OF TEACHING PROCESS

A. Curriculum content

At the end of the course/chapter, a student should be able to achieve the written outcomes. CO's and Chapter wise learning objectives are written below.

Course Outcomes (COs):

At the end of the course, a student should be able to identify, apply, distinguish, create, analyze and design whatever being asked to do, related to a specific chapter and specialization.

Chapter wise Learning objectives:

At the end of the chapter student should be able to learn the concepts of the topic with ease. One must be able to solve real time problems, challenges and issues related to the topics the objectives that are clearly based on the subjects

mentioned appropriately in each chapter. L1-L6 indicates the levels of blooms taxonomy.

B. Teaching-Learning Activities

An innovative approach to teach any course, it consists of following activities shown in Figure 2 which are incorporated in the theory course. It shows that course may be tightly coupled with active learning pedagogy tools that are used in the class room [5].

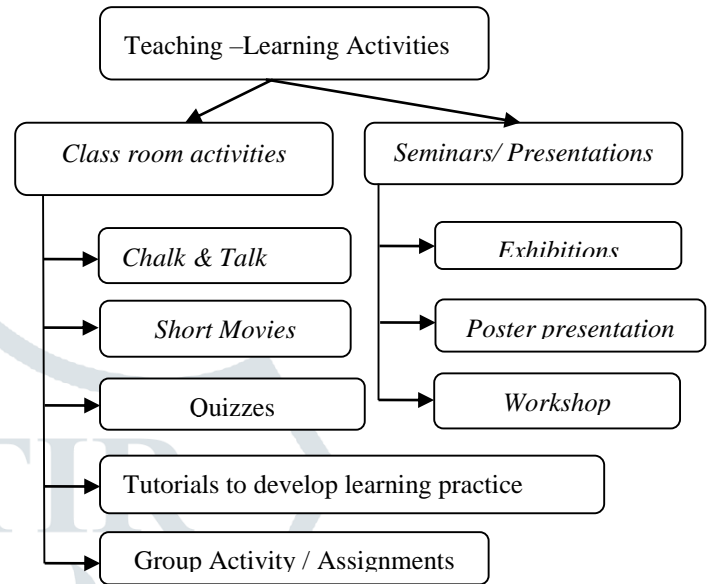


Fig. 2. Stack for Teaching-learning activities

1. Chalk & Talk

Chalk and talk method is a sort of one way communication that just provides certain information. Lecturers are unaware of the student's response and feedback. There is no much interaction between the lecturers and students. But this method may not be true for all the different courses. It may just end up in non-interactive and a boring session. Figure 3 depicts this kind of teaching process. But few students still accept it.



Fig. 3. Chalk and talk method

2. A short movie play in the class

Working of some of the difficult concepts of a course can explained nicely with a short movie play or by adding animations in the presentations.

Binary search and Bubble sort with animation. [Courtesy: Mr. Yusuf Shakeel [10]

Working of Tower of Hanoi algorithm can be explained in the class with animations as shown in figure 4 and many more .

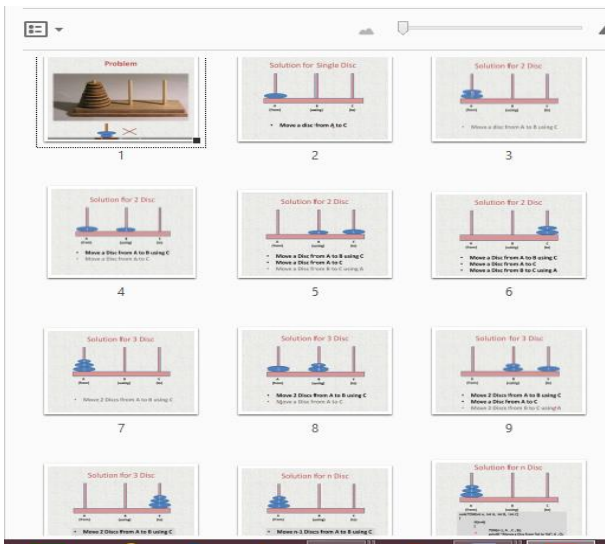


Fig. 4. Working of Tower of Hanoi

3 Quizzes

At the end of module (only for few), set of questions related to that module are asked to students in the form of quizzes for the better understanding of the topics. Different set of quiz papers as shown in figure 5 are prepared for Module end quizzes.

Qn	Question (Set)	Marks	BL	CO	Answer
1.	The instruction, MOV AX, 00FH belongs to the address mode a) register b) direct c) immediate d) register relative	1	L2	I	b
2.	The instruction, MOV AX, 1234H is an example of a) register addressing mode b) direct addressing mode c) immediate addressing mode d) based indexed addressing mode	1	L2	I	b
3.	The logic required for implementing a program can be expressed in terms of a) flowchart b) algorithm c) flowchart & algorithm d) none of the mentioned	1	L2	II	a

Fig. 5. Sample of quizzes conducted

4 Problem solving in session / Assignments

In the session depending on the topics many problems are solved. Tutorial may be conducted to solve more programming examples on Data structures, Microprocessors C- language and likewise. Figure 6 discusses about Contents covered in Tutorial classes (DSA) and figure 7 shows sample of Tutorial attendance sheet (MM)

**Department of CSE**  
**List of Topics discussed in tutorial**  
**Academic Year: 2019-20 (Odd)**

Subject : DSA (18CS32) Semester : III

Module No	Experiences worth noting	Date
01	• 3 days Workshop on C-revisit	22/07/2019
	• Topics revisited are • Programs on arrays	23/07/2019
	• Programs on searching • Programs on sorting • Programs on structures	24/07/2019
02	• Stack operations • Queue operations	30/08/2019
	• Conversion (Expression) using stack • Circular queue	06/09/2019 13/09/2019 16/09/2019
03	• Evaluation (Expression) using stack • Dequeue	26/09/2019 27/09/2019
	• SLL operations - Queue • SLL operations - Stack	03/10/2019 04/10/2019

Fig. 6. Contents covered in Tutorial classes (DSA)

Fig. 7. Sample of Tutorial attendance sheet (MM)

5 Group Activity

Students are given with few problem statements in a group as an assignment to write and execute C-programs. The sample of list of problem statements is shown in figure 8.

Sl	Stage of No	Program title	Assessment
1	1-15	1. C Program to find the area of the triangle if the side of triangle are given 2. Find the output of the following code Void main () { int i,j,k; i=10; j=20; k=30; printf("i = %d\n j = %d\n k = %d\n", i, j, k); }	Execute these programs in the lab during the lab hours or else take home the results to maintain or or send via signature
2	16-30	1. C Program to convert temperature from degree centigrade to Fahrenheit. 2. Find the output of the following code Void main () { int i,j=2, n=1; ...	Execute these programs in the lab during the lab hours or else take home the results to maintain or or send via signature

Fig. 8. C-Prblm statements as assignment in a group

Students asked to do group activity such writing C program for circular queues, stack and queues and tracing the programs. In group activity students help the different students in the group if in case they hesitate to speak to teacher. For OOMD course Batches are formed and different set of simple Real world problems of same levels are given to the batches for construction of class models. The sample f the same is shown in figure 9.

Sl	Topic
1.1	All objects have identity and are distinguishable. However, for large collections of objects, it may be hard to be certain that two objects are distinguishable. Furthermore, a value may depend on the position of the object. The result of the following collection of objects, describe how they could be described: a. All persons in the world for the purpose of national identification b. All countries with their respective time zone c. All telephone numbers in the world for making telephone calls d. All countries with their respective capital cities e. All electronic mail addresses throughout the world f. All employees of a company to ensure access for security reasons.
1.2	Select figure is a portion of class diagram for a complex program for playing several types of card games. Draw, hand, discard pile, and draw pile are collections of cards. The hand size of hand depends on the type of the game. Each card has a suit and a rank. Add the following operations to the diagram design: shuffle, deal, discard, new applicable, topCard(), peek, draw and discard. Some operation may appear in more than one class. For each class in which the operation appears, describe the arguments to the operation and what the operation should do to an instance of that class.

Fig. 9. Group Activity for OOMD

6 Presentations / Workshop

Different topics were given for the presentation to the students' group. Sample of the shown in figure 10.

Topics distributed for V Semester students for presentations with schedule

Batch	Roll No's	Topic	Day/Date
B1	1-10	Design Patterns: Introduction, what is a design pattern?, Describing design patterns	Friday 09/11/2018
B2	11-20	the catalogue of design patterns, Organizing the catalogue	
B3	21-30	How design patterns solve design problems, how to select a design patterns, how to use a design pattern	Saturday 10/11/2018
B4	31-40	Creatational patterns: prototype	Tuesday 13/11/018
B5	41-50	Creatational patterns: singleton (only)	
B6	51-60	Structural patterns : adaptor	Thursday
B7	61-68	Structural patterns : proxy	15/11/2018

Note:

1. While presenting topics allotted they should deal with the questions mentioned below
2. Dates are tentative, may change according to changes in the working days of college.

Fig. 10. Distribution of topics to students in batches

Workshops for the programming languages, microprocessors etc. can be planned. Senior student as resource person to talk about importance of C-programming language to 1<sup>st</sup> semester students. The same is depicted in figure 11.



Fig. 11. Senior student giving presentation in the workshop for C-language

C. Assessment Methods

Continuous Internal Examination (CIE) is done by conducting regular internal exams and quizzes/assignment/group activity etc. CIE and SEE for any course is done as per the Table I.

CIE evaluation is done by conducting internal exams, quizzes or assignments or group activity or presentation etc. Semester End Examination (SEE) is a written examination of three hours duration of 100 marks with 60% weightage.

Virtual class

Google class room is create for particular subject which will enable to learner to assess animations to think behind the class discussions with online chat with faculty for clarification as well it give the forum for group chat. This leads to have group discussion and sharing the knowledge[8]. The Google class created for Basic electronics subject tough for first year students which is shown in figure 12 . This class room helps to student to learn the basic with shot animation videos, chapter wise quiz, assessment and group Chat.

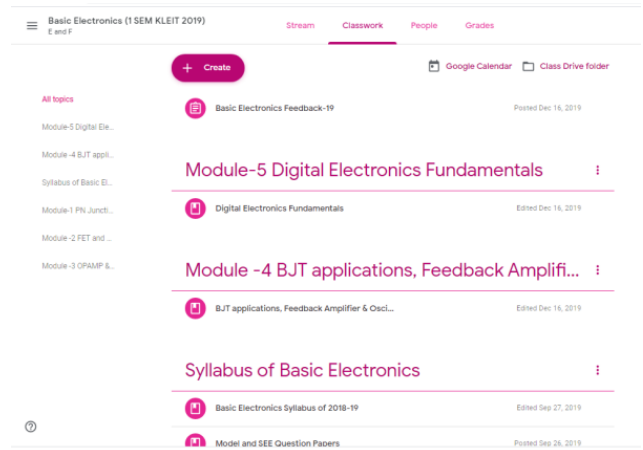


Fig. 12. Google class created for Basic Electroincs subject

Evaluation Scheme:

a. CIE Scheme

TABLE I:ASSESSMENT CRITERIA FOR CIE

Assessment Criterion	Marks allotted	Weightage in %
Internal Assessment 1	10	30%
Internal Assessment 2	10	
Internal Assessment 3.	10	
Unit Test/Quizzes/ Presentations Marks	06	10%
Two Assignment / Group activity	04	
<b>Final Internal Assessment</b>	<b>40</b>	<b>40%</b>

b. SEE Scheme:

▪ Semester End Examination (SEE) is a written examination of three hours duration of 100 marks with 50% weightage.

- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module

IV. RESULTS

Feedback is taken to understand impact of the approach followed in teaching the course. The results are really promising. The questions asked for OOMD course to the students are listed in Table II

TABLE II: LIST OF QUESTIONS FOR FEEDBACK (OOMD)

Sl. No.	Questions
1.	Describe the concepts of object-oriented and basic class modelling.
2.	Draw class diagrams, sequence diagrams and interaction diagrams to solve problems
3.	Choose and apply a befitting design pattern for the given problem in real world applications
4.	Introduction to course prerequisites.
5.	Clarity of the COs before the commencement of course.
6.	Teaching done to meet the outcomes.
7.	Quality of Notes, PPTs and other teaching aids used for teaching the course.

8.	Quality of Question paper in the internal assessments
9.	Adherence to method of Evaluation according to the scheme and solution.
10.	Teaching aids were appropriate for course.
11.	Difficulty level of unit tests and assignments.
12.	Able to draw the different models for a given problem.

The figure 13 shows the graph of the feedback for OOMD course. The answers expected by students are in the range of 1 to 3 (Disagree, Agree and Strongly agree). 40 out of 66 students are given the feedback.

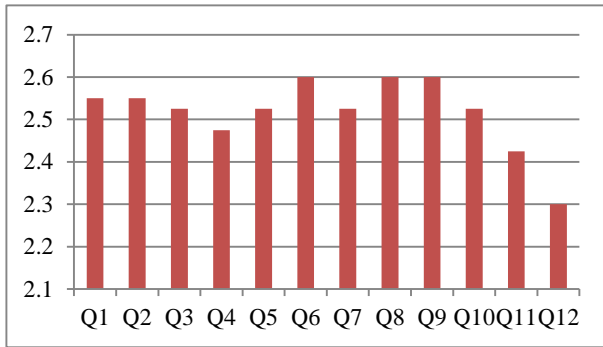


Fig. 13. Feedback results (OOMD)

The questions asked for MM course to the students are listed in Table III.

TABLE III LIST OF QUESTIONS FOR FEEDBACK (MM)

Sl. No.	Questions
1.	Acquiring knowledge on concepts of microprocessor and microcontroller.
2.	Effectiveness of teaching on projector.
3.	Usefulness of tutorial classes.
4.	Applying hardware architecture and software tools to build real world application.
5.	Method of conducting unit test.
6.	Difficulty level of unit test questions.
7.	Coding with assembly level language
8.	Instruction set of ARM processor.
9.	Memory Interfacing.

The figure 13 shows the graph of the feedback for MM course. The answers expected by students are in the range of 1 to 3 (Disagree, Agree and Strongly agree).

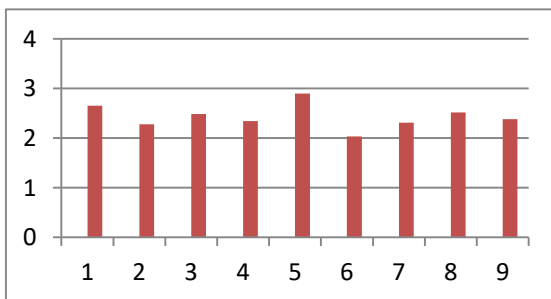


Fig. 14. Feedback results (MM)

The Graph in figures 13 and 14 show the rating to each question listed in table II and III respectively. The feedback provided by the students is very good. For figure 13, 15% of the students agree and 85% of the students strongly agree and for figure 14, 40% of the students agree and 60% of the students strongly agree that the innovative methods used in the class room helped to improve their understanding of the subject.

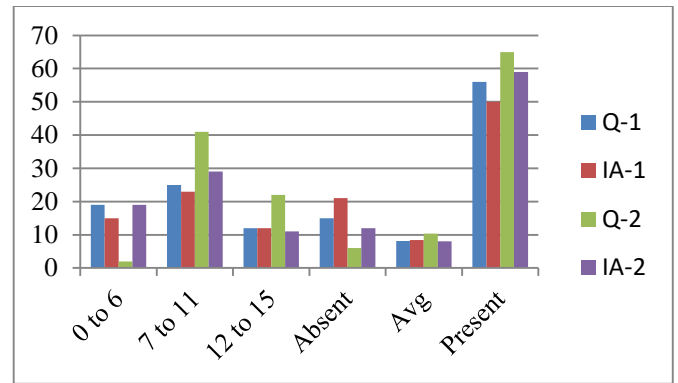


Fig. 15. Feedback results for quizzes (MM)

The approach taking module end quizzes helped the students to improve their performance in Continuous Internal Exams (CIE). The samw is depicted in the figure 15. Students also mentioned orally this approach helped them in the Semester End Exams (SEE) of that Course.

Google virtual class helps the student to lean and asses him/her self multiple times so that learning will be improved which can be asses and monitored and measure by himself/herself or the trainer/ Faculty. Indusial student or virtual class attended students can be assessed virtually and updated his performance of learning which is shown in figure 16

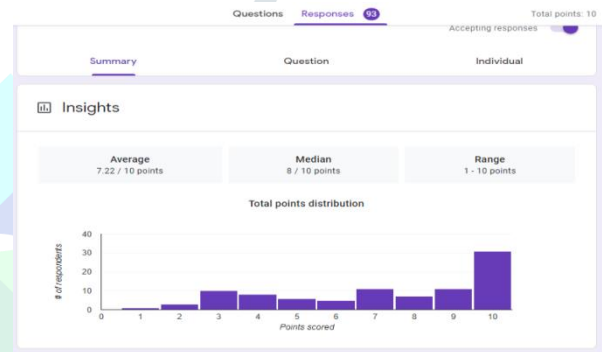


Fig. 16. Google class attendee reponce

The figure 17 is the feedback received in the workshop conducted for MM. These results are extremely good, even though this subject is taught for lower semester.

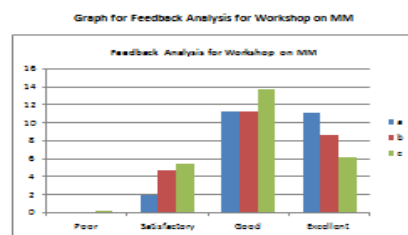
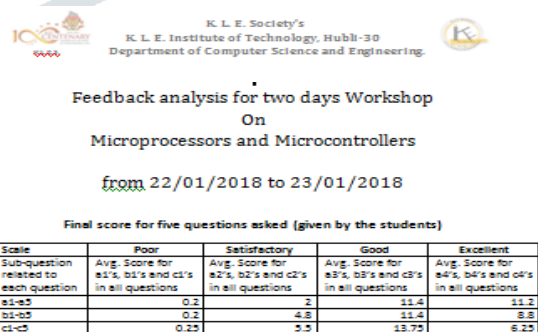


Fig. 17. Feedback for the workshop conducted (MM)

## V. CONCLUSION

The innovative approach that has been followed to teach the students has provided good results. The students were able to appreciate the class room learning and inculcate most of the things taught to them, as they were simultaneously realizing the concepts learned in class room through different activities such as quizzes, presentations, group activity, workshops and many more. This has laid to a strong foundation for various courses.

Performance in semester end exams has been improved. In all the activities, the assessment of student learning is focused on their understanding and application rather than on memory. There is an improvement in the understanding the subject according to the results obtained.

## ACKNOWLEDGMENT

Authors express gratitude to Principal Dr. Basavaraj S. Anami, Dr. Yerriswamy T. for encouraging and supporting the activities of Teaching-Learning process and providing the facilities for the same.

## REFERENCES

- [1] Petkovic, D.; Thompson, G.; Todtenhoefer, R., "Assessment and Comparison of Local and Global SW Engineering Practices in a Classroom Setting.", Proceedings of the Thirteenth Annual conference on Innovation and Technology in Computer Science Education, Madrid, Spain, June 2008.
- [2] Magdeleine D. N., Alwis, W. A., Henk, G. S., " Peer assessment in problem-based learning: Students' view ", IAEA Annual Conference, Cambridge, UK, 2008, 1-9.
- [3] Richard M. Felder Department of Chemical Engineering North Carolina State University "Designing and Teaching Courses to Satisfy the ABET Engineering Criteria", Journal of Engineering Education, 92 (1), 7-25 (2003).
- [4] Chandra R. Sekhar, Omer Farook and Essaid Bouktache, "Continuous Improvement Process Based on Outcome Based Education", Purdue University Calumet.
- [5] Scott Freeman, Sarah L. Eddy, Miles McDonough, Michelle K. Smith, Nnadozie Okoroafor, Hannah Jordt, and Mary Pat Wenderoth "Active learning increases student performance in science, engineering, and mathematics" Proceedings of the National Academy of Sciences June-2014, 111 (23) 8410-8415; DOI: 10.1073/pnas.1319030111
- [6] Juebei Chen , Anette Kolmos , Aida Guerra , Chunfang Zhou, Aalborg UNESCO Certificate: Staff Development and Challenges in PBL Training Programme Journal of Engineering Education Transformations, Special Issue No. 1, November 2019, Volume No.33, eISSN 2394-1707
- [7] Vidya Srikanth , Dr. Vimala Swamy , Dr. Vikas V. Shinde A Comparative Pedagogical approach in Vernacular Architecture: Theoretical method vs PBL method Journal of Engineering Education Transformations, Special Issue No. 1, November 2019, Volume No.33, eISSN 2394-1707
- [8] Izwan Nizal Mohd Shaharane, Jastini Mohd Jamil, and Sarah Syamimi Mohamad Rodzi "The Application of Google Classroom as a Tool for Teaching and Learning", Journal of Telecommunication, Electronic and Computer Engineering, ISSN: 2180-1843 e-ISSN: 2289-8131 Vol. 8 No. 10
- [9] Tracey Garrett, "Student-Centered and Teacher-Centered Classroom Management: A Case Study of Three Elementary Teachers" Journal of Classroom Interaction, ISSN 0749-4025. © 2008, Vol 43.1, pages 34 - 47
- [10] <https://www.youtube.com/watch?v=UeUyTbtFxQQ> and @dizauvi.com

