2.3.1: Student centric methods, such as experiential learning, participative learning and problem solving methodologies are used for enhancing learning experiences

Dr. Mahesh D. Goudar
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MIT ACADEMY OF ENGINEERING ALANDI (D), DIST. PUNE

Annexure I

Outcomes of Clubs at MITAOE and mappings of it in curriculum

There are total 24 clubs at MITAOE, the clubs are categorized as Technical, Recreational, Sports, Social and Cultural.
Each club has a well defined structure and monitored by the faculty member.
Each club has a semester plan for the events to be organized by it. Also each club targets reputed competitions in it's respective domain.
The clubs have outcome such as publications (technical as well as non technical), product developments, creative models, artifacts or performances.

Few Outcomes are enlisted below:

Technical clubs

- Autosports club : An Automotive Vehicle is designed and developed by the students. A detailed study and research for making the vehicle more efficient enables students to make a research paper and publish it in reputed journals or conferences. Till date 5 papers are published by this club.

- Robotics Club : For World skill competitions Mobile Robots are designed and developed by the students. Also for National Robocon a design document and robot is built for the given the tasks. Papers could be published on the study.

- Aero Modelling club : Aeroplane models and Quad copters are made for the SAE competitions by the students. Papers can be published by the club.

- Google Developer Club/ Hacker rank club/ Mozila Firfox/ girlScript/ REDx : Programs/ applications are generated for solving real world problems. Papers are possible through study.

- Design clubs : Design model and solutions are provided by the club. Papers are possible.

- Maths Club : Mathematical models are the outcomes

Recreational Clubs

- Photography club, Literary club , Art Elated Club,, Prakruti club Yoga and meditation club : Artefacts, creative , non technical blogs, poems, articles can be few outcomes.

Cultural Clubs/ sports clubs : Creativity, Performances, Skill acquired are the outcomes of the clubs .

Mapping of Club outcomes to Existing Course curriculum

Technical Clubs

1. Auto-sports – CFD, Engineering drawing and Engineering Design
2. Design Club:
3. Robotics club- Robotics and control system minor track , Embedded systems
4. Google Developer Club/ Hacker rank club/ Mozila Firfox/ - Programming Subjects/ logic building subjects
5. GirlScript/ REDx - Data Science and Machine learning minor tracks
6. Aero modelling/ Quad copters – Control systems, IOT, Embedded systems
7. Cyber security club- Cyber security Track
8. Maths Club- Mathematical subjects
9. Spark Club – Electronics , communication subjects

Non Technical Clubs

1. Literary club : English Communication, Professional Studies
2. Photography/ art elated/ cultural courses - Personality development courses, team work,
3. Sports/ cultural – Confidence, Body language/ inter personal skills, team building etc

About Liberal Learning course (Audit Course)

One sample Course is attached (Photography)

COURSE OBJECTIVES:
• To promote the art and craft of photography. • To help people gain knowledge that will further enhance their skills in photography through workshops, photo walks, exhibits, seminars and other projects within and outside College campus. • To open the doors for students & staff of the college to participate in various photography activities in the regional, national and international. • To train members to become socially responsible leaders by participating in community

development activities.

- To promote responsible photo journalism as an informative tool that can help us understand subjects of social relevance, as well as a tool to show nationalism and Indian pride.
- To allow people to see through photography what they do not usually see.
- To make the enjoyment of photography accessible to a wider community.

Lesson 1	**Principles of photography**	**1 Hours**
Introduction to photography, Types of camera, Basic camera controls.		
Lesson 2	**Light & Lenses**	**1 Hours**
Types of Lights, effect of Lights, Types of Lenses & their uses		
Lesson 3	**Understanding the Exposure Triangle**	**1 Hours**
Understanding the three main ingredients or elements or pillars of photography that work together: Aperture, Shutter Speed, and ISO.		
Lesson 4	**Understanding ISO Sensitivity**	**1 Hours**
Understanding the concept of ISO sensitivity, in detail with hands-on session		
Lesson 5	**Introduction to Shutter Speed**	**1 Hours**
Understanding the concept of Shutter Speed, effect of high & low shutter speed on photographs, with hands-on session		
Lesson 6	**What is Aperture? Introduction Lesson**	**1 Hours**
Concept of aperture, F-stop notations, effect of variation of aperture on images. Hands-on session		
Lesson 7	**Framing and composition**	**1 Hours**
Compositional Rules like Rule of Thirds, Negative Space, Horizon Line, Golden ratio etc. Framing. Hands-on training		
Lesson 8	**Auto and manual focus, Depth of field**	**1 Hours**
Difference between Auto focus & manual focus, Focusing the object manually, concept of depth of field with wide aperture lens. Hands-on		
Lesson 9	**Portrait and product photography**	**1 Hours**
Concept & Hands-on		
Lesson 10	**Close-up & Macro photography**	**1 Hours**
Concept & Hands-on		
Lesson 11	**Landscape & nature photography**	**1 Hours**
	Framing in landscape photography, bird photography framing	

Lesson 12	Creative aspect	1 Hours
	Bokhe effect, Time lapse, multiple exposure, Silhouettes, Long exposure, Steel wool photography.	

1. **Assessment scheme:**

- Students will have to submit one photographs along with EXIF, for every lesson based on photography concept/genre.
- Exhibition & competition will be organized for every photography concept/genre and peer evaluation will be carried out for the same

2. **Intake capacity for the course: 50**

3. **Provide resource names for in-house:** Vedant Lachke, Aditya Chavan, Rutwik Deshmukh (Club Mentors), Amol M. Kapse (Faculty coordinator),
External resources: Abhijeet Chillal, Sarang More, Aniket Gunda

Few Snaps of Club Achievements

Quad-copter winners

National Hackathon winners

Aero modelling AIR 17

Go Kart winners

Baja Vehicle

A Sample of Autosports club events and achievements

Name of the Club: **NIYUDRATH KARTING – Autosport's Club**

Name of The Club in Charge (Faculty member): **Prof.B.R. Patil**

Name of the Captain: **Ganesh Andhale**

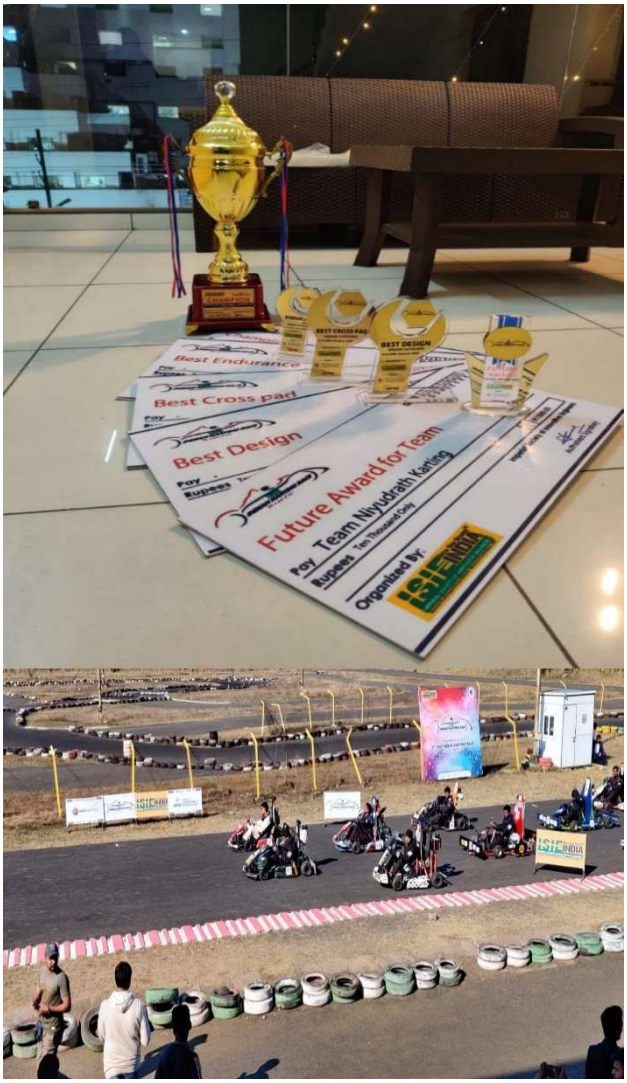
1. **Details of Event organized**
   (Date, Venue, no. of participants, photos, posters any other relevant information)

   i. **Vehicle Dynamics - Autosports Internship (In MITAOE)**
   Date: 1st June – 1st July 2020
   Venue: Online thought Google Meet
   Number of Participants: 10
   An Internship was organized, in which students were though Vehicle Dynamics, along with software's like CATIA, FUSION360 and also ANSYS. In the span of 30 days, they were thought how to make a chassis, brakes system, powertrain and steering system in a Gokart.

   ii. **Sponsors Meet (In MITAOE)**
   Date: 6th February 2020
   Venue: Takshashila Lawn, MITAOE Campus
   Number of Participants: 30
   We have conducted the sponsors meet to thank all the sponsors for their help. Also, in that meeting all the sponsors were given an appreciation certificate by our college Director Dr.M.D. Gaudar and our FY Dean Prabha Kasliwal.

2. **Details of Participation outside MITAOE**
   (Date, Venue, no. of participants, photos, posters any other relevant information)

   i. **ISIE IKR Season 5.0 (National level event)**
   Date: 21st Jan – 25th Jan 2020
   Venue: RPM Circuit, Bhopal
   Number of Participants: 19
   To participate in the event and won the championship.



ii. Edgeline Gokart Championship Season 1.0 (National Level Event)

Date: 27th Sept – 1st Oct 2020

Venue: Online thought Google Meet

Number of Participants: 7

To participate in the event and won the championship.

3. **Award/ Achievement/ Recognition**
   (Date, Venue, no. of participants, photos, posters any other relevant information)

   i. **ISIE IKR Season 5.0 (National level event)**
   Date: 21st Jan – 25th Jan 2020
   Venue: RPM Circuit, Bhopal
   Number of Participants: 19
   Won the following awards
   - 1st overall champions
   - 1st Best Design
   - 1st Best Cross pad
   - 2nd Endurance
   - 2nd Business Plan
   - 3rd Acceleration
   - Future Award

   Total prize money of **1,30,000/-** was bagged by the team.

   ii. **Edgeline Gokart Championship Season 1.0 (National Level Event)**
   Date: 27th Sept – 1st Oct 2020
   Venue: Online thought Google Meet
   Number of Participants: 7
   Won the following awards
   - 1st Design Presentation
   - 2nd Business Plan

   Total prize money of **5,500/-** was bagged by the team

4. **Digital Presence of club through social media (Likes , engagement on FB, Instagram, Twitter, Youtube channel of your Club)**

i. **Season Video for ISIE IKR event**
   https://www.youtube.com/watch?v=vaqIK02ANB4
ii. **Season End Video – AYRTON 1.0 Complete journey**
   https://www.youtube.com/watch?v=QDG-L0Eejfg
iii. **Instagram Page**
   https://www.instagram.com/niyudrathkarting/

5. **How many alumni are associated with your club with details? (Alumni Engagement)**

   8-10 Alumni are associated with this club; the number is less because this club is recently formed. The club has successfully completed 1 year

MIT Academy of Engineering

Case Study on Project-Based Learning
Course – Design Thinking

Prepared by
Dr. MAYA M. CHARDE

Synopsis/Abstract:

Design thinking is an approach which focuses on Human-Centric problems to provide innovative solutions. It focuses mainly on desirability, feasibility and viability. Before introducing PBL through this course learners were facing some problems. They were not able to empathize the users, unable to think creatively, innovatively and precisely, unaware about the customer choices, needs, satisfactions, types and their behavior, unaware about the market survey, trends and sustainability etc.
Considering the learners needs and for their continual improvement we at MITAOE, Alandi pune being an Autonomous Institute introduced this course in 2016 for F.Y. B.TECH. Students. Only three faculties were trained and visited the GARDI University and some of our sister institutes for attending the trainings for course delivery and for designing the curriculum. Initially the faculties were little bit worried about the course delivery as this was newly introduced and also don't have an idea about how the learners will respond to this PBL teaching. So to explain about the need and necessity of PBL in DT during orientation and also conducted the survey.

1. Introduction

PBL Journey – for the Case Study

- **How it started:**
  - Design thinking is an innovative continuous quality improvement solution oriented methodology. As per need and necessity of current era while we were visiting various national / international universities and reputed industries we came to know that Design Thinking is playing a very significant role in quality improvement of the same.
  - With outcome of this methodology industries like Infosys and universities like Stanford, Olin etc. are progressing rapidly. They are very much satisfied with the result of this methodology while implementing at their end.
  - Being a reputed institute, we have decided to accept and implement this methodology in our curriculum as a PBL course as Design Thinking in view of surviving in a competitive educational world and to fulfill the future and existing needs of an Industrial sector.
- **What were drivers/reasons:**
  - **Drivers:**
  - To implement the course effectively a team of creative thinkers people were identified / built.

- To deliver the PBL the curriculum of the course Design Thinking has been framed by taking the guidance from various universities and Industrial experts.
- To train the Faculties/Instructors/Staffs various training programs like IUCEE, Online Teaching tools, In-house trainings, Training by GARDI University, Industrial trainings, Faculty exchange program, MOU with Foreign universities, Training at sister institutes, Staff development programs etc. were arranged /organized/conducted.
- To deliver the course effectively Design thinking laboratory has been developed with modern equipment / machineries / setups etc.
- **Reasons to implement PBL in DT :**
- To enhance the problem identification and problem solving skills of the instructor as well as learners.
- To imbibe project based learning and to inculcate the critical problem solving skills of the learners.
- To give the best solution for user centric problems through PBL.
- To bridge the gap between the Academics and Industrial revolution with respect to Education and Industry 4.0 concept.

- **What were challenges**

  From learner's point of view:

  Some of the Challenges while identifying the problem as an individual:
  - To identify and finalize the domain.
  - To have a keen observation capability to identify the top 10 activities of the domain.
  - To identify the problems/challenges of the user while performing the activities.
  - To finalize the user for whom solution need to be addressed.

  Some of the Challenges while giving the solution to identified problem as a group:
  - To work in a group with coordination and synchronization was a big challenge.
  - To check whether all the members from group are working in full capabilities and with 100% involvement and dedications or not.
  - To implement the idea / solution in optimum / stipulated time, with best utilization of all the available resources and optimum cost.

  From instructor's point of view:

  Some of the challenges are:
  - To identify the type of learners especially weaker learners.
  - To form the groups of learners for execution and completion of a project.
  - To keep the record of an every learners.
  - To give the training for soft skills to learners.
  - To make the learners social competence for best use of Design thinking methodology with PBL.

- **Lessons Learned**

  Transform the learners by giving the platform as a course DT is itself is a good opportunity to develop their social skills, soft skills, and technical skills.

  Following are some lessons which we have learned and implemented to overcome the various challenges:
  - Formation of groups on the basis of learner's area of interest and combination of learners from different streams so that the variety of thinkers/learners will shape up their personality with best solutions.

- Conducted the various activities like Visual Thinking, Think - Pair - Share along with various teaching styles so that the learners will able to know everyone from their group to work together on common domain effectively and instructors will also able to involve the learners effectively.
- Explaining the case studies as an example for identify the activities/ problems/challenges etc. of the domain.
- Assigning graded activity to an individual along with group activity so that they will be more attentive and also involve in each activity/task/assignments of their groups.
- Explaining the importance of desirability, feasibility and viability through some examples / case studies so that the learners will try their level best to get best solution.
- Instructing learners to keep the evidences/ records of each and every activity they performed while doing the market survey/customer's feedback/interaction with users etc.

After the successful implementation of PBL in DT the concept and need of PBL has been identified and implemented for various courses like Prototyping, Mini / Minor / Major projects and in every courses wherever is applicable depending on its suitability.

2. Current Status

Currently, the enhanced PBL is introduced in F. Y. B Tech course (Design Thinking) from 2020-21. About 311 students are involved in the PBL related activities / course.

Table 2.1: Involvement of course, subject, students, faculty members, lab resources, etc in PBL for 2020/2021 academic year

Name of Depts / Schools / College	Title of the course	Title of Subject	No. of Students	No. Faculty Members	No. of Labs	No. of Mini projects	No. of Trained Faculties	Remarks if any
SHES	F.Y. B.Tech.	Design Thinking	310	05	03	72	05	2nd run of this course

Note: Table 2.2 is optional

Table 2.2 Byproducts of Involvement in PBL Journey till 2020/21 Academic Year.

No. of completed projects	No. of Completed Prototypes	No. of Research Publications	No. of External Collaborations	Remarks if any
72	72	03 papers and 01 patent	05	Till Second Run

(*virtual mode so working prototype model)

2.1 Sample Lesson plan:

Phase wise sample Lesson plan for the course Design Thinking:

Phase I: General Problem Statement & Background, **Phase II:** Research Methodology, **Phase III:** Design Brief, **Phase IV:** Ideation, **Phase V:** Concept Evaluation, Validation & Detailing, **Phase VI:** Prototyping,

2.2 Student Assessment

- **Continuous assessment / Internal Assessment: (40 marks)**
  Completion of AEIOU framework (i.e. Activity sheet, Environment Sheet, Interaction sheet, Object Sheet, User Sheet) and three canvases (like Empathy canvas, Ideation Canvas and Product Development Canvas) for documentation of project work.
  These eight sheets have been evaluated on the basis of well-defined rubrics.
- **Practical Examination / External examination (35 marks)**
  In practical examination the evaluation of the project is mainly focused on (Prototype) working model and three parameters like problem definition, contribution towards evolving the concept and prototype model have been considered with defined rubrics.

2.3 List of external collaborators for PBL as applicable

- B. H. Gardi Vidyapeeth; Rajkaot.
- Design LIFE, Address 2nd Floor, B Wing, Raheja Plaza 1, Opp. R-City Mall, Off, L. B. S. Marg, Ghatkopar West, Mumbai.
- MAEER'S MIT Institute of Design, Pune.
- Aalto University, Finland.
- Mahindra, Chakan.

3. Current Challenges (as of August 2021)

- Hands on experience is missing due to pandemic.
- For guiding interdisciplinary projects needs to involve more number of faculties
- Students are unable to connect due to their different locations for preparing good quality of working prototype model.
- Cannot go for physical market survey and users feedback

4. Proposed Plans for 2021/22

Table 4.1: Involvement of course, subject, students, faculty members, lab resources, etc in PBL for 2021/22 academic year

Name of Schools	Title of the course	Title of Subject	No. of Students	No. Faculty Members	No. of Labs	No. of Mini projects per subject	No. of Trained Faculties	Remarks if any
SHES	F.Y. B.Tech.	Design Thinking	300	05	03	72	05	For the 2nd Run

Table 4.2 Byproducts of Involvement in PBL Journey for 2021/22 Academic Year (Estimated).

No. of completed projects	No. of Completed Prototypes	No. of Research Publications	No. of External Collaborations	Remarks if any
72	72	02	05	Considering impact of pandemic

.

5. Recommendations

- I recommend that there should be an opportunities for National / International level project competitions where the students can explore their Design Thinking project skills.
- I will recommend myself to guide the colleges/institutes for including this subject in the curriculum with PBL.
- Faculty exchange programs to share the experiences and better practices.

6. Conclusions

Project – Based Learning is an innovative and a systematic way of Teaching – Learning Methodology. It helps to explore the creativeness of the learners to solve the problems of different domains and to provide effective solutions for the same. It allows the learners for their overall personality development through critical thinking (Divergent – Convergent – Divergent thinking).

7. References

[1] Nigel Cross, Design Thinking: Understanding How Designers Think and Work, Berg Publishers (May 15, 2011), ISBN-13: 978-1847886361
[2] Project based Learning in Engineering Design Education: Sharing Best Practices, Dr. Aruna Shekar, Massey University.
[3] Tim Brown, Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation, Published September 29th 2009 by Harper Business, ISBN 0061766089

MIT Academy of Engineering
Electrical & Electronics Engineering - Problem Based Learning

Prabha S. Kasliwal, Mandar Bhalekar, Satish Kabra

Synopsis/Abstract:
The fundamental objective of the course Electrical and Electronics offered in FY BTech is to give an overall exposure of the Electricity generation, transmission and distribution further scope is to introduce circuit board design found in hybrid electric vehicles, consumer electronics equipment. Our Institute is autonomous and this course was introduced in the academic year 2016-17. This subject has evolved over the time from project based learning(PBL) experimented in 2018-19 to problem based learning in 2020-21.
It helps students to explore analog and digital systems design required for telecommunication, computers hardware and embedded applications. This subject introduces sensors, transducers and actuators which are basic building blocks for robotics and automation. It also gives a complete overview of measuring and data acquisition system design. At present clean energy generation is a simple theme towards good living. Fundamental knowledge of 1-ph. AC and 3-Ph. AC supply is must for all budding engineers and electrical motors required for domestic & Industrial application which must be selected as per application point of view.

1. Introduction
PBL Journey – for the Case Study

We were keen on bringing a Sustainable development goal(SDG) in the curriculum. Students were aware of the green energy generation. We felt that this is the need of the hour to understand the calculations for solar power generation as per consumer's power requirement. Students are taken to visit the solar plant situated on the rooftop of the institution. Initially students were eager to read solar panel nameplate ratings. This experience gave them a clear idea of solar panel installation and connections. The activity consists of preparation of the report which includes off-grid electrical load calculations and estimate the battery and panel ratings and quantity. Consumers must know electricity energy bills details and Power factor benefits.
Automation is a buzzword for engineers. Taking this as an opportunity we introduced small projects in the start to help students develop a block diagram approach for small automation systems. The application questions in paper were designed to assess the students for their cognitive skills in this domain. Practically we asked students of batch 20-21 to identify a problem and offer a solution, design and simulate in Tinkercad. In the current scenario students developed an automatic sanitizer dispenser machine using a PIR sensor.
Thus rather than thinking of a project the students were made to observe activities in society, identify problems and then think of the ways it can be solved.
During our problem based learning journey we introduced application based question of blooms taxonomy level 6
Some of the application oriented questions from question paper

- For a 6 lit. Washing Machine, LED is used as an indicator to indicate overweight. Suggest the design using OP-AMP as comparator which is used to switch on the LED to show overweight. Explain the working with proper waveforms.
- Suggest the automation for traffic light controllers at a 4 lane junction. Describe the block diagram.
- Suggest and explain the block diagram for obstacle avoidance robots.
- In a cricket team selection panel, Four members team is the panelist. Any player will be selected only when at least three panelists cast votes in his or her favor. Design a circuit for helping team selection.
- Propose block diagram for home automation.

Drivers/reasons-

To give an exposure and significance of Sustainable development goal 2030 and its need for addressing them through classroom learning. The key factors through which we triggered the PBL were involving students in the process of active observations and identifying potential problems to be resolved. Many times students find it difficult relating and mapping academic knowledge gained to the applications found around them.

Imparting students with the values that they have to give back to society . Making students aware that privileged engineering students should offer engineering solutions for society.

Challenges-

- When we implemented project based learning in the first two academic years we observed that the project titles were getting repeated and the same projects were presented by different groups in rotation.
- Some senior students developed a business model of developing the project and giving it to students.
- Motivating the students in taking initiative
- Tuning the students' view to come out the traditional PBL mode.
- Motivating the faculty and wholehearted involvement in the process
- Online mode working prototype was difficult

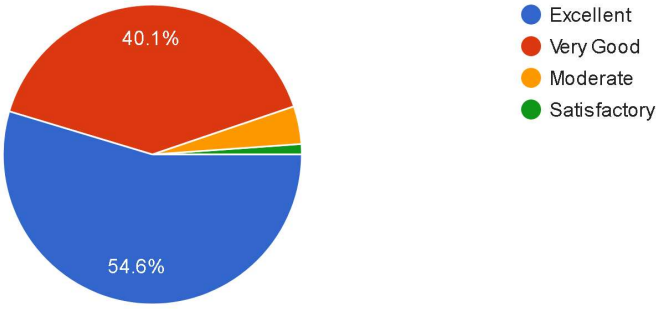
Lessons Learned-

- Difficult to assess the contribution of teams for a small projects
- Not accepting project tile but involving students creatively in process of identifying problems
- Redesigning the course in online mode

Course exit survey

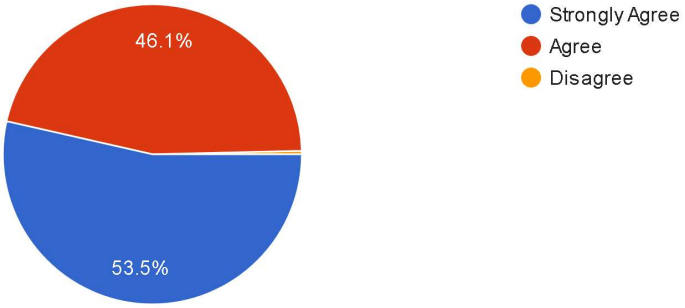
How do you rate the content of the course

269 responses



Overall learning experience is enhanced because of, effective use of teaching aids, student centric teaching learning methods (such as experi...tive learning and problem solving methodologies).

269 responses



2. Current Status

We received very good support and feedback from students during the journey.
Even we were not able to see the working Model but simulation and ideation actually helped
The course is going to be interesting when we conduct it in the offline mode.
In class activities and face to face discussion with guide will help in formalizing the concept of PBL in EEE subject.

Table 2.1: Involvement of course, students, faculty members, lab resources in PBL till 2020-2021 academic year

Name of Depts / Schools / College	Title of the course	No. of Students	No. Faculty Members	No. of Labs	No. of Mini projects per subject	No. of Trained Faculties	Remarks if any
FY BTech	EEE	600 (Sem-I 300 & Sem-II 300)	3	24 Batches	1	2	Journey from Project based learning to problem based learning

Sample list of title of 5 Mini projects for the subject

1. Solar based smart street lightning System
2. Solar based water pumping system
3. Bluetooth Speaker Design using solar
4. Battery Charger using solar
5. Home automation system
6. Sanitizer Dispenser

2.1 Sample Lesson plan

EXPT	Experiment Planned		CO No.	Date of Plan
A	1	Introduction to Power system, Neutral & Ground, Safety precaution, Applications & **Visit to Solar power Generation Station**	1	04/02/2021
B	2	Electricity Distribution in Campus and Interpreting the Electricity Bill	2	11/03/2021
C	3	Prototype of automation system/ simulation in Tinkercad	3	18/04/2021

2.2 Student Assessment Policy

Type	Examination	Syllabus	Marks	Mode of Assessment	Weightage in Final Score	Total Marks

Practical (EX102L)	Continuous Assessment	Practical List	80 (or as per no. practical assignment)	Practical performance	20	50
	End Sem Assessment	Prototype of project	30	Demonstration/ Report/ Review Writing	30	

2.3 List of external collaborators for PBL as applicable

Fourth Partner Energy Private Limited, Hyderabad
Maharashtra State Electricity Distribution co. Ltd.

3. Current Challenges (as of August 2021)

Lack of practical exposure and field visits

4. Proposed Plans for 2022/23

Indicate proposed plans for accelerating and enhancing infusion of PBL in the subject to overcome the challenges listed in section 3 as well as in line with the National Education Policy 2020.

5. Recommendations

- Problem based learning can be suggested for every subject to enhance the student's creativity.
- Also it can improve the Industry Institute Interaction
- Increased Scope due to automation revolution in Industry

6. Conclusions

PBL journey is interesting and implementation in the right direction will boost the quality of projects.

7. References

Course conducted at MIT AOE

MIT Academy of Engineering

Case Study on Problem -Based Learning –

Experimental Tools and Techniques

Prepared by

Mr. Murtuza Dholkawala

Synopsis/Abstract:

Experimental Tools and techniques have been introduced in FY B Tech for the purpose to inculcate and make students understand various engineering tools and to develop inquisitiveness to learn technologies by opening their minds to study what's in it. The objective of this course is to provide hands on experience to the student in engineering tools and techniques that are essential in various streams of engineering. Safety being prime important issue will be discussed before every laboratory work and care and maintenance of tools and equipment used will also highlighted during each experiment. Measurements of various engineering quantities will be prime part of the subject. Assembly and its function along with function of engineering unit will be demonstrated during lab work. During the course students will perform various activities. These activities are to be carried out in groups and after finishing these activities they have to identify a live problem. They can reach to solution to identified problem by making a prototype.

1. Introduction

PBL Journey – for the Case Study

- **How it started**
  - To give hands-on practice five modules from core engineering branch were introduced
    - Mechanical Engineering: To make mechanisms, Open IT for various equipment's like refrigerator, Automotive systems, Mechanical Measurements for various parameters.
    - IT/ Computer Engineering: Demonstration of various components of standard desktop computer, Networking, MS Access, Google Tools, HTML, Website design
    - Electronics Engineering: PCB Soldering, Demonstration of DC Motor, Open IT for Washing machine.
    - Chemical Engineering: Open IT Water Purifier, Water testing for Indrayani River.
    - Civil Engineering: Making of Bamboo structure

- **What were drivers/reasons**
  - To bridge the gap between theory and practical.
  - Open IT of any equipment and analyze the system.
  - Industry experts as jury for projects done in various modules
- **What were challenges**
  - Time constraint for hands on
  - Funding for various projects.
- **The following strategies were used for addressing the challenges faced**
  - Removed project segment, instead small activities are designed

After the completion of the first batch using the PBL teaching methodology, a survey of students was conducted. Following are the responses from the students conducted through survey.

- **Student response**: - They had 24 practical sessions where they learnt different tools and techniques along with, they had 10 open Lab experiments where they not only studied but also opened various components like mixer, microwave, water purifier, Air conditioners, CPU, engine etc. There was a high-level involvement by students for the same. The response has been verified by rubrics.
- **Student participation & involvement:** -The students after learning these tools and techniques came up with different projects which can be combination of two disciplines or an individual one. Students are making live projects like Pet band, Eco-San toilets, Straw-Bale Construction, Hovercraft, drone etc.

The following crucial lessons were learned from the first run of the PBL.

- Open IT for any
- Support of stakeholder
- Management of expectations

2. Current Status

Table 2.1: Involvement of course, subject, students, faculty members, lab resources, etc in PBL till 2020/2021 academic year

College	Title of the Program	Title of Subject	No. of Students	No. Faculty Members	No. of Labs	No. of Mini projects per subject	No. of Trained Faculties	Remarks if any
MIT AoE	FYBTech	Experimental Tools & Techniques	640	5	5	60	5	Repeated since 2016

Table 2.2 Byproducts of Involvement in PBL Journey till 2020/21 Academic Year.

No. of completed projects	No. of Completed Prototypes	No. of Research Publications	No. of External Collaborations	Remarks if any
50	5	0	0	First Run

Sample list of title of 5 Mini projects for the subject

Sr. No	Title of the project	Sample pics
01	Green Roads	
02	Rover	
03	Generation of electricity by rain water and solar	

2.1 Sample Lesson plan

Activity based PBL for various modules offered from various branches. Open IT is preferred in each module.

2.2 Student Assessment

Rubrics are designed for all the activities. Peer Assessment if preferable.

2.3 List of external collaborators for PBL as applicable

- Mr. Subhash Mali, Veritas Principal Lead-Infrastructure
- Mr. Prashant Patil, Director- Apex Consultants
- Mr. Mense Yogesh Bajaj Auto, Asst. Manager
- Mr.Sachin Selvaraj, Yashus Digital Marketing Pvt. LTd

3. Current Challenges (as of August 2021)

Prepare a list of challenges in the implementation of PBL for the subject(s):

- Lockdown due to pandemic
- Example Lack of resources like availability of machinery

4. Proposed Plans for 2022/23

Indicate proposed plans for accelerating and enhancing infusion of PBL in the subject to overcome the challenges listed in section 3 as well as in line with the National Education Policy 2020.

Table 4.1: Involvement of course, subject, students, faculty members, lab resources, etc in PBL for 2022/23 academic year (Estimates)

Name of Depts / Schools / College	Title of the course	Title of Subject	No. of Students	No. Faculty Members	No. of Labs	No. of Mini projects per subject	No. of Trained Faculties	Remarks if any
College	F. Y. Tech. in	Experimental Tools & Techniques	640	5	5	Nil	5	For Next Academic year

- Enhancing collaborations among member institutions through sharing sessions
- Identifying potential collaborations

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Case Study on Enhanced Project-Based Learning in a Course "Prototyping"

Prepared by
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Abstract:

In the quest of quality education and to fulfil stakeholder's expectations, we have implemented project based learning in some of the courses in year 2016. A product design course "Prototyping" was one of the earliest courses to implement PBL at our institute. After conducting three rounds from year 2016 to year 2019, we have applied Enhanced PBL in year 2020-21. This case study presents brief account for course conduction with enhanced PBL. We have presented insight for different challenges faced and strategies used to solve the problem.

1. Introduction

PBL was first introduced in a year 2016 for second year engineering students of all branches in "Prototyping" (ET206) course in autonomous curriculum. This was the first time implementation of the course. Prior to this period the institute was implementing university prescribed curriculum of Savitribai Phule Pune University, Pune. In year 2016 institute has got academic autonomy and the process of new curriculum design was initiated. There was no similar multidisciplinary course in university curriculum. We have got suggestion from members of Board of studies to introduce a product design course, which will include basic skills of foundation engineering branches like Mechanical, Electronics, Computer and Civil engineering. Four faculty groups, one group for each category were formed to design proposed multidisciplinary syllabus. The course was categorized in Program Core Category within the group Skill development and projects. This is compulsory course for all seven branches of second year. The team proposed four prototyping modules for this course, Electronics, Computer, Civil and Mechanical prototyping respectively.

During period year 2016-2019 around 1700 students were completed all the four modules one by one, in round robin manner. Initially there was concern about course administration; as course was conducted by four different schools with one module each. Another concern was related to student response to this multidisciplinary, new teaching methodology. After conduction three rounds of this course for three years; we were having ample number of observations to enhance project based learning in next revision. The syllabus revision was conducted for this course in year 2020 for tenure 2019-2023 and two new courses of 02 credits were designed. The module structure is keeping structure of same. Now course is split in two courses i) Digital prototyping ET224 (Modules: Hardware & Software Prototyping) ii) Rapid Prototyping ET235 (Modules: Civil & Mechanical Prototyping) and all modules will be conducted for entire year in two semesters.

Following section presents discussion about Challenges faced aimed at Old course for Three years and first run of new modified course based on enhanced project based learning during years 2016-2019 and year 2020-21.

Table 1.1 Challenges and strategies were used for addressing (2016-2019)

2016-2019(Old)	Challenges	The Strategies used to address
a) Faculty	Training need	*Faculty Development programs*
	Laboratory set up	*Visits to the institute of repute*
b) Students	Teamwork	*Activities like Brainstorming were conducted for enhancing teamwork*
	Time Management	*Enhanced time , Extra lab hours*
c) Technical Aspects	Only one centralized product theme/idea	*Broad theme with scope for creativity/Traditional Indian knowledge*
	Blending Product design & Electronics technology	*Technology part was more Dominant, More focus on Basic electronics Skills*
	Physical Implementation	*Component Availability problem solved locally*

Table 1.2 Challenges and strategies were used for addressing (2020-2021)

2020-2021(New)	Challenges	The Strategies used to address
a) Faculty	New Course design	*More emphasis was given on Product Empathy, Project based Collaborative learning.*
	Course Duration	*Old course is spilt in two courses with enhancement in credits*
	100% Online course Conduction	*Proper Platform & Learning new tools for online activity conduction*
	Online Course material	*LMS[Moodle,Collpoll) & Repository for Recordings of sessions*
b) Students	Teamwork	*Online collaborative activities*
	Effect of Corona Pandemics	*Provision of extra round for affected*
	Connectivity, Unavailability of laptops	*Online/offline tools were used, Training of Mobile apps were given*
c) Technical Aspects	Product Realization	*Use of Simulation tools preferred*
	Product Evaluation	*Industry expert evaluation*
	Concept Validation	*Customer feedback was included*

The performance grades/marks of the students were compared with the previous year results, and they are shown in graph in Fig 1.0 After the completion of the first batch using the enhanced PBL teaching methodology, a survey of students was conducted. Results of the pre and post-survey are depicted in Figure 2 .0

Fig 1.1 Comparison of performance

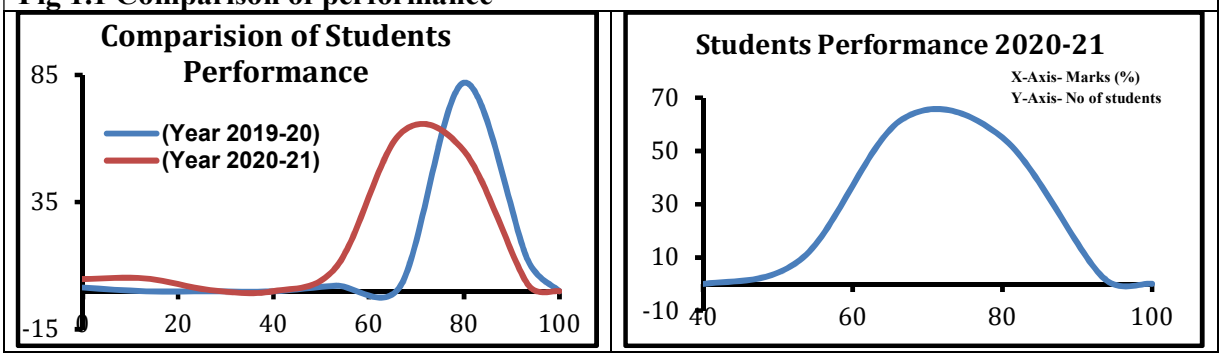
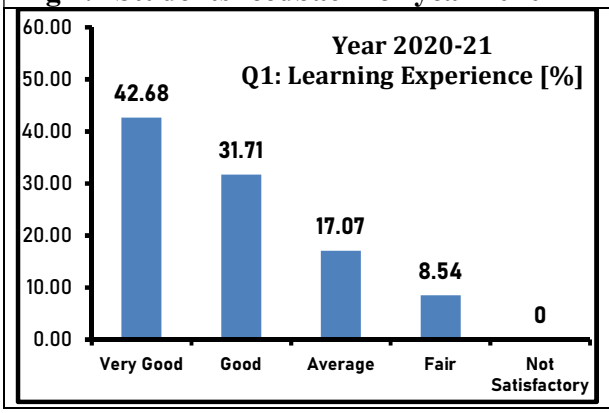
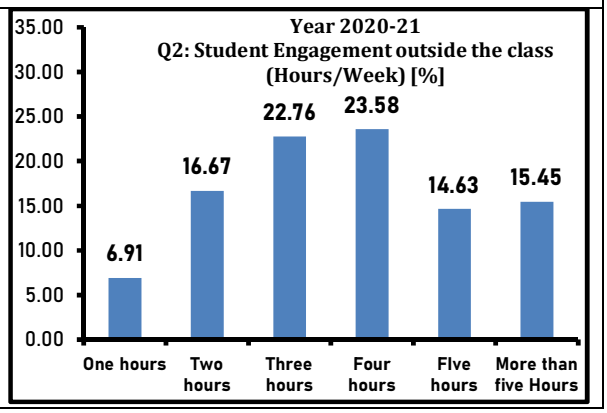


Fig 1.2 Students feedback for year 2020-21





The following crucial lessons were learnt from the first run of the PBL.

- Support of stakeholders is very significant
- Management of expectations from all the stakeholders
- Improvement in assessment methods
- Time management is a key factor

2. Current Status

At present enhanced Project based Learning is introduced in the courses i) Digital Prototyping (ET224) ii) Rapid Prototyping (ET235) for all the programs. Around 600 students are appearing for in these courses for the year 2021-22

Table 2.1: Involvement in PBL till 2020/2021 academic year

Name of Departments	Title of the course	Title of Subject	No. of Students	No. Faculty Members	No. of Labs	No. of Mini projects	No. of Trained Faculties	Remarks if any
Civil Chemical Computer Electronics E&TC, IT Mechanical	Second Year B.Tech.	Digital Prototyping (ET224) [Modules: Hardware Software]	600 /Year From 2016-17 to 2020-21	14	8	150	10	1st run of new subject

Sample list of titles of 5 Mini projects for the subject is presented in table below

Table 2.2: Sample list of Mini projects titles/themes for academic year (2020/2021)

No	Hardware Proto *(Electronic Product)*	Software Proto *(Web/Mobile App)*	Mechanical Proto *(3D Printing/Assembly)*	Civil Proto *(Bamboo based structures)*
i)	Auto hand Sanitizer	e-Governance	Gears, Differentials	Bamboo Truss
ii)	Touch less tap water	Smart City	Couplings/Parts	Bamboo Joints
iii)	Earthquake Alarm	Digital Marketing	Robotic parts	Bamboo Table/Chair
iv)	Vegetable Cleaner	e-Commerce	Mouse	Bamboo Shoe rack
v)	Refrigerator Alarm	Disabled people	Car/Bike Models	Bamboo xylophone

2.1 Sample Lesson plan for course module Hardware Prototyping

Out of four modules of the course, Lesson plan for course module "Hardware Prototyping" is presented here,

L1- Product Concept Development (06 Hours)

i) Group formation ii) Problem/Product Definition iii) Brainstorming in Team iv) Conceptual Drawing v) Cost Estimation vi) Product Planning vii) Requirement Analysis viii) Specification development ix) Competitor Survey

L2- Basic Electronics Skills (06 Hours)

i) Soldering ii) Wiring iii) Assembly

L3- PCB design using basic Electronic Design Automation tools (06 Hours)

i) PCB Design Concepts & standards ii) PCB Software tools iii) online tools & Mobile apps

L4- Circuit Simulation, Testing and Measurements (06 Hours)

i) Circuit Design and Simulation ii) Test and Measurements iii) Performance Analysis

L5- Product Finishing and Validation (06 Hours)

i) Cabinet Design ii) Product Manual iii) Product Promotion iv) Customer Feedback v) Industry expert evaluation

L6- Product Presentation (06 Hours)

i) Product final report and Bill of Material ii) Group presentation iii) Thanks giving and Course end Survey

2.2 Student Assessment

The course Digital or Rapid Prototyping (ET224/ET235) consists of two modules each. Each module is evaluated for 75 Marks. An Assessment scheme for one Module i.e. Hardware Prototyping is as shown below,

Table 2.3: Students assessment scheme

No	Assessment Head	Marks	Activities
i)	Internal Assessment	25	04 Group activities & 04 Group Assignments
ii)	Demo/Presentation	50	Group Presentations & Demo

2.3 List of external collaborators for PBL

In our courses, we have external collaborations with external agencies/industries like Autodesk for Fusion 360, PCB Design software vendors for hands on training etc.

3. Current Challenges

A list of challenges in the implementation of PBL for the subject(s):this course are listed as below,

- Lockdown due to pandemic
- Lack of Hand on learning for basic skills in institute Laboratory
- Physical product realization into market
- Product Registrations

4. Proposed Plans for year 2021/22

Proposed plan for accelerating and enhancing infusion of PBL in this course to overcome the challenges is listed below

Table 4.1: Involvement in PBL for 2021/22 academic year (Estimates)

Name of Departments	Title of course	Title of Subject	No. of Students	No. Faculty Members	No. of Labs	No. of Mini projects	No. of Trained Faculties	Remarks if any
Civil Chemical Computer Electronics E&TC IT Mechanical	Second Year B.Tech.	Digital Prototyping (ET224) [Modules: Hardware Software]	650 02 Semesters	18	10	160	14	2nd run of new course

5. Recommendations

Based on experimentation at our institute, we will suggest providing adequate weightage for basic engineering skills and hands on experience through project. Also students must be acquainted with Design Thinking, Product design process and System life cycle functions during project based learning. Finally for most of engineering courses, must comprise hands on, skill based project to ensure Project based learning as a best practice.

6. Conclusions

It was challenging situation for us to implement project based learning in the product design course Prototyping. During this journey of implementation, we find that the creativity and interest of our students has enhanced significantly. Also, even in difficult time of corona pandemics our students have shown good performance and delivered desired learning outcome.

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