Enhancing faculty competencies through Engineering Exploration & Design Project Course

Subodh S. Ingaleshwar[1], Athar M Jamadar[2]

[1]Department of E & TC, Rajarambapu Institute of Technology, Sakhrale, Sangli Maharashtra
[2]Department of Civil Engineering, Rajarambapu Institute of Technology, Sakhrale, Sangli Maharashtra
[1]subodh.ingleshwar@ritindia.edu
[2]athar.jamadar@ritindia.edu

Abstract:
It's a well known fact that enhancing students' competency is directly proportional to enhancing faculty competency. Motivation for this paper is how to enhance faculty competencies in this competency driven education system? Changing times are transforming the nature of competencies that have been valuable throughout history, such as communication and collaboration. A teacher is responsible for the developing or deteriorating interest from a course. If teacher takes such a task unprepared then whole bunch of students may suffer its consequences. Scope of this project/paper is facilitating faculties who wants to deliver a multi disciplinary, PBL pedagogy based course effectively. This papers attempts to enhance 21st century competencies into faculties by a taking a case study of Engineering Exploration and Design Project Course hosted for freshman year students. The subjects in our research are Faculties Teams from seven different disciplines. The data is collected through Questionnaire. Lastly the data is verified with students feedback to whom these faculties are delivering the course.
Major finding of our study are with appropriate, team driven policies we can imbibe 21st Century Competencies among faculties.

Keywords: Engineering exploration, Design project, communication and collaboration.

Subodh S. Ingaleshwar
Dept. Of E & TC, Rajarambapu Institute of Technology, Sakhrale, Sangli-415409, MH
Subodh.ingleshwar@ritindia.edu

1. Introduction

The role of a teacher in higher education is an important dimension of the academic profession. In modern times, teachers who have appropriate qualifications and are having an experience in academic activity are expected to take a series of professional roles throughout their career, including those of a teacher, researcher, manager and community contributor [6]. In this paper we are sharing our experience with respect to role of teacher in delivering a course introduced in freshman year of Bachelor of Technology with an intention of making students realise the 21st century need of engineer, as solution provider.

The demographics of higher education have changed in these modern times and are regularly updating day by day with the invention & invocation of technology. Today's degree seekers are more diverse than at any other point in our educational history. Many more are part time workers while attending college. A major driver of this demographic shift has been the evolution of competency-based learning, which provides non traditional students with newfound flexibility and opportunity to realise their potential and channel it into progressive direction. This transformation is not, of course, without profound challenges and considerations. Among them, how should the role of faculty evolve in a competency-based learning model?

Dr. Richard Senese [6], in his article mentioned, curriculum and instruments used to measure and evaluate student competency have to be developed by the faculty, who are ultimately responsible for providing feedback to students on their competency assessments. Our faculty expertise is also enhanced through the assignments and as mentors, who help students, navigate both academic concerns and non-academic aspects. The multidisciplinary team provides more time and energy for faculty members to focus on the individual learner when providing feedback on the demonstration of the competencies addressed in the authentic assessment. Faculty members should see the distribution of these roles as a positive aspect of their involvement in this delivery model.

2. Related work

Competencies in the views of [2] are the certain characteristics or abilities of an individual that enable them to perform appropriate specific actions. It represents the capability that an individual brings to the job and when the responsibilities of the job to produce the desired results require the demonstration of specific actions, the individual draws from inner resources for the capability to respond.

Competency enhancement on the other hand is a term used to describe measures taken within a course, program, or institution to enhance or strengthen quality (www.lfhe.ac.uk/governance/hefastfacts/jargon.html). It involves steps and measures taken by a person or groups of persons in order to heighten; increase, (especially to increase or improve in value) quality and desirability. Competency enhancement is a topic of great interest in today's academic society and one of the tools we need to utilize if we are to solve the lingering problem facing the educational sector [3]. Thus according to [4] Human asset is one of the most important resources available to any organization, and employee competence as well as commitment largely determines the objectives that an organization can set for itself in relation to the extent she can achieve success in them.

The "Competency-based" approach to human resource management has become integral during the last thirty years, with „Competency" encompassing the knowledge, skills, abilities, traits and behaviours that allow an individual to perform a task within a specific function or job [5]. Finally we can summarise, competencies are the effective combination of Skills, Knowledge and Abilities combined to increase or improve the value of work at hand.

In this paper we have discussing the different competencies developed among a multidisciplinary team of faculties jointly came to deliver a multi faculty delivery course known as Engineering Exploration & Design Project (EEDP) introduced for Freshman year students. We are effectively concluded that with appropriate policies defined, sufficient resources at hand and good understanding of outcomes we are able to attain the overall improve or increase the value of work at hand.

The outline of the paper is as follows. The section 2 describes the various definitions competencies given at their individual time period and its definition at the end Section 3 represents the EEDP Course details along with different activities conducted. Section 4 describes competencies areas in teaching, problems encountered and measures taken to overcome along with policy scheme. Section 5 discusses the results in terms individual faculty feedback and authenticated by the students feedback.

3. EEDP Course Details

The EEDP Course is designed by a group of faculties from KLE Technological University and offered under NETRA(R) (National ESDM Technology Research Academy) as Vertical Engineering Exploration.

3.1 Course Description:

The Engineering Exploration & Design Project is introduced as 2 credit course in first year for students enrolled in all discipline. Course contents can be described under

a. Introduction to engineering & engineering study concepts with a centralised theme based on on critical thinking, creativity, teamwork, communication, and working across different engineering disciplines.
b. Students will be introduced to various disciplines and their integration for a developing a solution provider mindset. Contents centrally based on concept of engineering design process through a semester-long project, providing a design-built-test experience.
c. EEDP Course makes students familiar with Project management concepts and Constraints Management, Multi-disciplinary nature of engineering, problem solving approach via Platform Based Design (PBD), Data Acquisition Analysis (DAA), Team Building, and Engineering Ethics & Sustainability.

The EEDP course delivery mechanism is activity based delivery with ideal goal of not delivering a monologue beyond 10min. Students are expected to complete the Design Project parallel to the delivery of course by practically applying the engineering concepts/principles taught in the course. Need statements are carefully selected by experts with brain storming, modular implementation and practice by faculties. Students are taught to convert this need statement into Problem statement. The task is group task, form a team of four students, and implement the project with project management tools in multi-disciplinary engineering field under the guidance of course teachers. The continuous assessment of the Project work will be carried out by evaluating project work.

3.2 Course Learning Outcomes:

After successful completion of the course, the students will be able to,

1. Explain the role of an Engineer as a problem solver.
2. Design engineering solutions to complex problems utilizing multi-disciplinary systems approach.
3. Examine a given problem using process of engineering problem analysis.
4. Build simple systems/prototypes using engineering design and development process.
5. Analyse engineering solutions from ethical and sustainability perspectives.
6. Apply basics of engineering project management skills in project development.

Uniqueness of this course is its activity based delivery by a team of multidisciplinary teachers. These teachers are trained under PBL Pedagogy and Active Learning Techniques. Formation of team along with development of roles and responsibilities of each member is very much crucial for the success of this course. Fig 3.1 shows the hierarchical representation of EEDP Course delivery team .

To promote peer learning we extend the invitation to various student association who has contributed to the remarkable improvements in the quality of Design Projects.

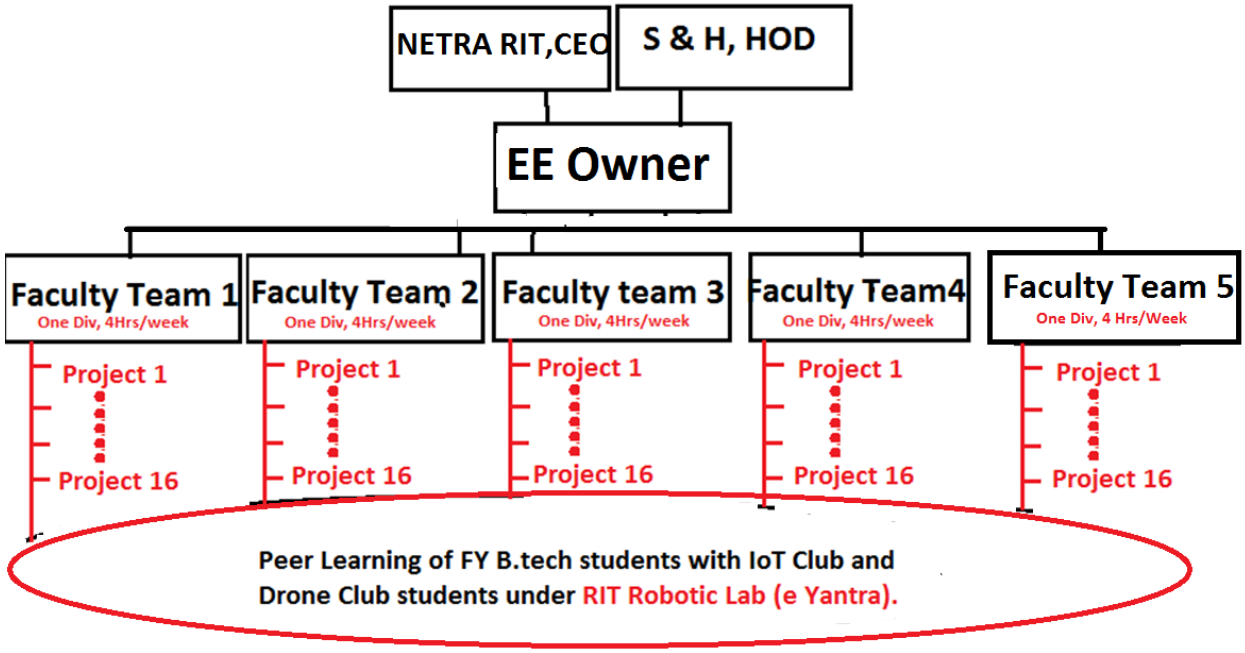


Fig.3.1 The Hierarchy diagram of EEDP Course struuture

In Outcome Based Education, Peer learning has bidirectional advantages. The learning peers as well as teaching peer both are benefitted in the interaction.

3.3 Roles and Responsibilities:

EE Owner: EE Team Leader will be responsible,
1) For presentation of EEDP RIT to outside worlds.
2) For tangible outcomes like Publications, FDP's.
3) For Managing and Finalizing the need statements.
4) For checking the quality of Modules prepared by Module Owners.
5) For checking the quality of Module Delivery.
6) Improves the quality of Design Project Implementation.
7) Check the Activity prepared will suit the purpose or not.
8) Activities prepared by Faculty Teams should be approved by EE Owner.
9) Responsible to maintain weekly updates from EE Team Leader.

EE Team Leader: EE Team Leader will be responsible,
1) For implementation of Modules as per approvals from EE Owner.
2) For facilitating fellow member's activity preparation.
3) For sorting our queries of fellow member's Design Project Implementation.
4) For procurement and distribution of materials for activities and Design Project.
5) For integrating & preparing team efforts in the form of paper.

EE Team Member: EE Team Leader will be responsible,
1) For delivering modules in strict format of activity based delivery.
2) For checking with lab assistants preparation of materials required for delivery of modules.
3) For contributing in the paper be based on selected theme.

4. Competency areas in teaching

As compiled by different experts in higher education teaching learning in their hand book [1], below are the competency areas to be inculcated among faculties when they are teaching to higher education,

1. Mastery of academic discipline in service of the teaching process.
2. Professionalism and professional development of higher education teachers.
3. Curriculum planning and development in higher education.
4. Learning and students.
5. Planning, organising and implementing the teaching process.
6. Assessment and self-assessment of student achievements.

7. Mentoring & application of new technologies in teaching
8. Communication and social skills

EEDP course content covers an extended curriculum starting from Introduction to Engineering & Engineering study, to contents derived from Mechanical, Electronics, Computer Science and Civil Engineering also. Hence faculties have to be thoroughly prepared before going for delivery. Based upon mutual analysis of course contents and delivery, the EEDP course touches upon all nine areas mentioned above but we are concentrating mainly on four areas namely 3, 5, 6 & 7 whose analysis can be done effectively.

Since the course has been hosted first time that is in AY 2018-19 for first year freshman students, the percentage contribution assigned by us decided by mutual discussion for each area is given below,

Area 3: Curriculum planning and development in higher education.
Percentage assigned 35%.

Area 5: Planning, organising and implementing the teaching process.
Percentage assigned 35%.

Area 6: Assessment and self-assessment of student achievements.
Percentage assigned 35%.

Area 8: Application of new technologies in teaching.
Percentage assigned 10%.

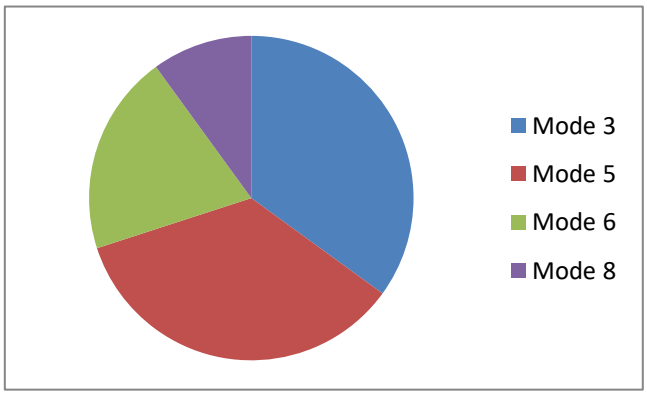


Fig 4.1, Percentage distribution of areas contributing to EEDP Course for Academic Year 2018-19.

Fig. 4 shows the same in pie chart form. The percentage contribution can be varied based on your delivery team discussions and conclusion. Next academic year we may not require 35% for area 2; hence we may modify and concentrate mainly on area 3 and area 4 which benefits in the form of improvement in the quality of projects.

5. Results

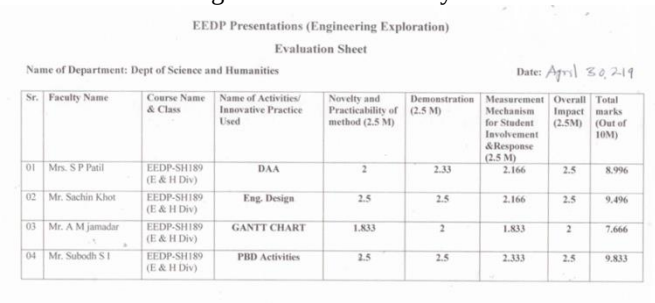
Results of faculties involved in the delivery of the course is quantified by two ways,

5.1 Method 1: Organised Presentations in-front of Expert Committee:

Each faculty has to present in-front in front of a committee known as Best practices committee, the overall contribution to the course via different criterion like,

a) Novelty: Carries weight-age of 2.5M/10M
b) Demonstration: Carries weight-age of 2.5M/10M
c) Tools used to quantify students involvement & response: Carries weight-age of 2.5M/10M
d) Overall Impact: Carries weight-age of 2.5M/10M

One Faculty Team includes four faculties and one such sheet is shown in fig 5.1.a for one Faculty Team.



EEDP Presentations (Engineering Exploration)

Evaluation Sheet

Name of Department: Dept of Science and Humanities Date: April 30.2.19

Sr.	Faculty Name	Course Name & Class	Name of Activities/ Innovative Practice Used	Novelty and Practicability of method (2.5 M)	Demonstration (2.5 M)	Measurement Mechanism for Student Involvement &Response (2.5 M)	Overall Impact (2.5M)	Total marks (Out of 10M)
01	Mrs. S P Patil	EEDP-SH189 (E & H Div)	DAA	2	2.33	2.166	2.5	8.996
02	Mr. Sachin Khot	EEDP-SH189 (E & H Div)	Eng. Design	2.5	2.5	2.166	2.5	9.496
03	Mr. A M jamadar	EEDP-SH189 (E & H Div)	GANTT CHART	1.833	2	1.833	2	7.666
04	Mr. Subodh S I	EEDP-SH189 (E & H Div)	PBD Activities	2.5	2.5	2.333	2.5	9.833

Fig 5.1.a Expert Committee evaluation Sheet

In fig 5.1.b, Expert committee evaluation for all criterions is shown. The bar chart is plotted for max. Of 2.5Marks

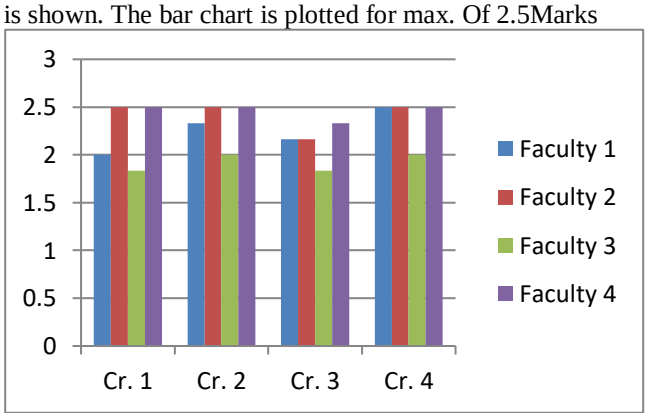


Fig 5.1.b Expert Committee evaluation in terms of bar chart

Fig 5.1.c shows the criterion wise Team Average, again calculated for max. Of 2.5Marks.

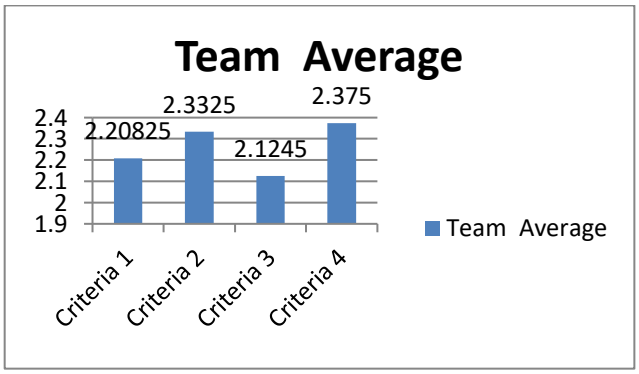


Fig. 5.1.c Criterion-wise Team Average (Out of 2.5)

Fig 5.1.d shows the criterion wise Team Average, calculated in percentage.

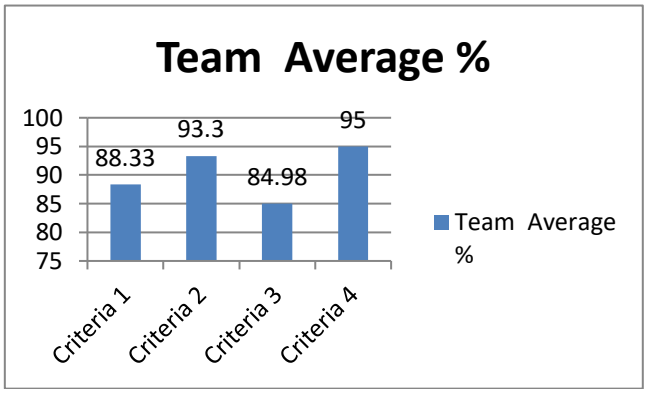


Fig. 5.1.d, Criterion wise Team Average in percentage.

5.2 Method 2: Students Feedback

In this method, we have taken feedback of students for the same criterion mentioned in Method 1. This analysis is of 59 students of one division where the above said Faculty team has delivered this course. Fig 5.2.a shows criterion wise student's feedback in percentage.

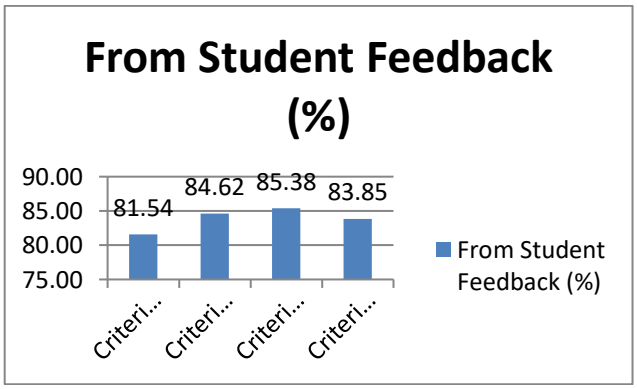


Fig.5.2.a, Criterion-wise Students feedback in Percentage

Fig 5.2.b shows the comparison of data analysis of both methods. Comparison shows students feedback has out grown the feedback calculated from experts committee.

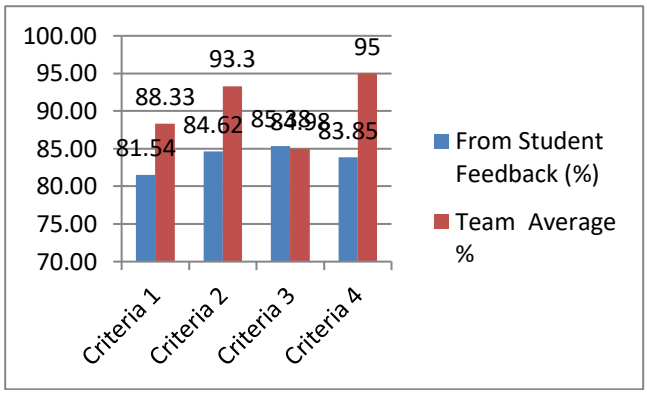


Fig. 5.2.b Criterion wise comparative of both Methods

6 Conclusions

From the above proposition we can conclude that the faculty competencies are significant part of Teacher in role of teaching. Hence an assessment method is discussed which shows that faculty competencies are to be enhanced continuously for the proper direction & success of the course.

ACKNOWLEDGEMENT:

Firstly, we are indebted to NETRA RIT Chapter for creating a space where courses of such dimension can be accommodated. Their constant support and encouragement will always motivate us to constantly evolve for betterment of Engineering Exploration.

Secondly, we are grateful to Dr. G H Joshi and his Team, KLE Tech university, by assisting us in all possible ways including resource sharing, mentoring, tutoring and empowering us to devise our own strategies suitable for our institutes needs and constraints.

Lastly, we are indebted to our Institute Hon. Director, Management, Deans and all HODS's for making us part of this team and supporting us in all possible manners.

References

[1] Handbook For Teaching Competence Enhancement In Higher Education by Publisher: Ministry of Science and Education (2018).

[2] Vathanophas, V. & Thai-ngam, J. (2007). Competency requirements for effective job performance in the public sector, Contemporary Management Research,3 , (1), 45-70.

[3] Whawo, D.D. (1997). An introduction to the study of education (2nd ed.). Benin City: World of Books Publication.

[4] Akanwa, U. N. & Eluwa, I. O. Evaluating Competency Enhancement Needs of Lecturers for Quality Teaching and Learning in South-East Universities of Nigeria. IOSR Journal of Research & Method in Education (IOSR-JRME)e-ISSN: 2320–7388,p-ISSN: 2320–737X Volume 4, Issue 2 Ver. II (Mar-Apr. 2014), PP 01-05.

[5] Boyatzis, R. (1982). The Competent Manager: A Model for Effective Performance. NewYork: John Wiley & Sons.

[6] Newsletter "The Shift toward Competency Starts with Faculty by Richard Senese" on Mar 24, 2016.