4. ROLE OF RESEARCH & DEVELOPMENT IN ENGINEERING EDUCATION

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Abstract

This study describes the present scene of research and development activity and its link along with the main feature of teaching-learning process i.e. classroom teaching. The study aims to find out the present scenario of Research activity in some of the engineering colleges and the perceptions received from stakeholders of the education process . It also covers the present shortcomings of class room teaching-learning process and the necessary steps to overcome the shortcomings. Finally it describes how involvement of a teacher in a research activity helps in becoming a teacher in a real sense of the term.

Keywords *: Research & Development, Teaching- learning process, Stakeholder*

INTRODUCTION

In the present era, research in technology is performing the role of foundation of a multi storeyed engineering education building. The main objective of this paper is to focus on relevance of research in engineering education and efforts are made to present the scene of teaching process in engineering education.

Research and Development concentrates mainly on the activities listed below

- Invention of something new
- Presenting the existing one in new form
- Use existing in effective way

In today's technological world engineering community across the globe is continuously working for the betterment of human life through research activity. Technology is changing with very fast speed. We all are experiencing the progress of technology via newspaper, television, internet network etc. As technology is improving constantly, the curriculum of engineering program/course needs to be improved accordingly. Engineering education has become so vibrant and dynamic that it demands equal amount of dynamism at the level of curriculum planning and execution. Teacher is one of the important stakeholder of the education process. Teacher needs to live and lead in such dynamic atmosphere. This drew attention towards relevance of research in engineering education [1]. Some institutions have gained popularity and good name in the society because of few reasons listed below

- Involvement of faculty, staff and students in research activity
- Organizing workshops, seminars, conferences with the help of faculty, staff and students
- Encouragement for generation of new ideas by involving stakeholders
- Committed work

The thoughts have evolved and concentrated on the study of the present status of research

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activity in some of the engineering colleges. The detailed survey has been conducted as a part of research work [2]. The information on all the important processes along with research activity has been collected with the help of questionnaire and personal discussion with the different stakeholders such as the teachers, management members, students and industry. The questionnaire included a set of questions related to research activity and teaching – learning process. The input received through responded questionnaire on research scaled down by using Likert scale and measured against maximum 50 points. The score obtained has been given in the table 1. The first column of the table gives the number of colleges approached and rest of the columns are showing score obtained from different stakeholders.

Table 1 Research and Development activity score for 10 colleges

Stake holder / College	Student (50)	Teacher (50)	Mgt (50)	Industry (50)	AVG (50)
1	35	20	17	20	23
2	40	30	46	30	35
3	40	35	31	30	34
4	20	05	05	05	10
5	20	05	13	10	12
6	20	05	10	05	10
7	20	05	10	05	10
8	25	10	15	10	15
9	25	10	15	10	15
10	45	50	45	40	45

The score gives us input differences from the stake holders. The histogram showing score of the colleges/institutions for the 'Research Activity' has been shown in Figure 1. X axis represents colleges and the Y axis represents the respective average scores obtained for the 'Research Activity'. It can be observed that the research activity has not received much attention in these colleges except the college 10 which is the government approved centre for the research activity. The feedback score obtained for research activity is in general very low.

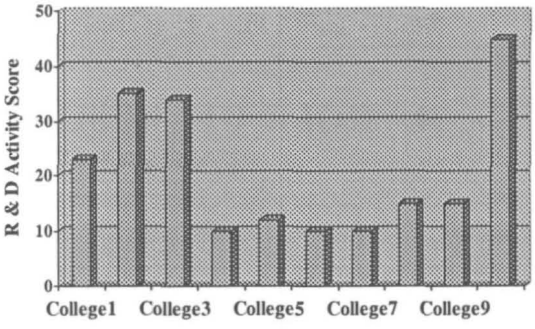

Figure 1. Research & Development with Overall Score of 50 Points.

In Table 1, the last column shows average score obtained by each college for the research activity. However input is obtained from different stakeholders, but analysis has been extended by applying ANOVA- a statistical tool. This tool is used for getting the perception of the different stakeholders. ANOVA is useful for the analysis of the activity/ process where more than two variables are involved [3].

APPLICATION OF ANOVA FOR RESEARCH ACTIVITY

ANOVA has been done by using Duncan Multiple Range Test (DMRT) to find the perception of different stakeholders. The values of DMRT means are obtained wherein Y1, Y2, Y3 and Y4 represent different stakeholders namely students, teachers, management and industry respectively.

$\overline{Y}_1 = 29$, $\overline{Y}_2 = 17.5$, $\overline{Y}_3 = 20.7$ and $\overline{Y}_5 = 16.5$

The above result shows that 2 and 4 are not significantly different. Also 3 is not significantly different from the above two. Thus score obtained from teacher and industry are very much the same. However, student has given the highest score as can be seen from the box plot shown in Figure 2.

In Figure 2, X axis represents Block means colleges 1-10, Treatment 1, 2, 3, 4 means response from students, teachers, management, and industry whereas Y axis represents score

obtained from these stake holders [4].

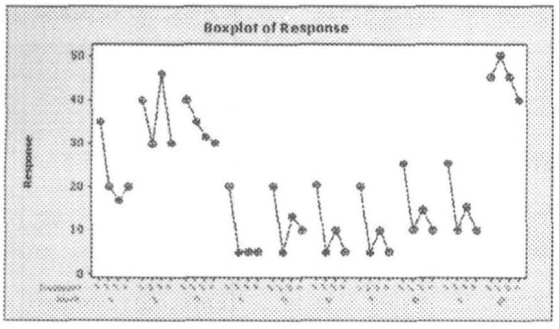

Figure 2 Box plot for Research Activity

The Figure 2 shows perception of different stake holders about research activity and from this the observation can be made that only students have given high score but rest of the stakeholders have given low scores. It means, research activity needs to be addressed at different level to bring it in proper shape.

TEACHING –LEARNING PROCESS [5]

Engineering education consists of many activities and to name few of them, are listed as below

- Admission
- Scheduling time for teaching and learning
- Teaching and learning
- Examination
- Evaluation
- Examination review etc.

Teaching and learning process is one of the most important activity amongst many as above. There are many methods of teaching- learning process. The most popular and traditional method is the class room teaching. The class room teaching requires human resource in the form of Teacher. There are several backgrounds of teachers. It varies based on qualification, experience and the preparation of lectures for teaching process. The background of teachers is enumerated below [6].

1.1 Teacher (fresh / with below experience years)

- Needs lot of efforts in understanding the subject matter
- Performs several rehearsals of what he/she is going to teach in a specific class.
- He/She judges the performance of teaching based on response of students with regard to degree of silence maintained by students.
- Only thinks about points to be covered and needs frequent support of text book.
- Adds very little about various applications of subject matter.
- Incorporates hardly any thing from speciality books/ conference proceedings / Journals

1.2 Teacher (with experience of 10-20 years)

- Only thinks about main points to be covered and their sequence.
- Adds fairly good amount of applications.
- Adds things from speciality books/ conference proceedings / Journals.

1.3 Teacher (with experience more than 20/25 years)

- Thinks about main points to be covered and their sequence.
- Adds good amount about applications.
- Adds substantial information and knowledge from speciality books / conference proceeding / Journals / papers reviewed / thesis examined/ sponsored project reports
- Starts with interactive style of teaching for some topics.
- Covers syllabus with emphasis on interactive sessions.
- Main focus on the latest topics with justification for the questions starting with why, what, when, where and how.

SHORT COMINGS IN THE TEACHING - LEARNING PROCESS

As per above information some teachers conduct classes with the preparation based on the normal syllabus, whereas experienced teacher conducts interactive classes with more stress on application part of the technology and case studies. For interactive classes, preparation requires input from different sources like seminar, workshop, conference proceedings, journals, standard publications etc. Ideally a person interested in teaching profession with the background of Master's Degree with 10 years of teaching experience is expected to reach to a 3rd stage of teaching background as stated in point number 1.3 . It has been made possible for the teachers of national and international institutions where research activity is given importance and considered as routine activity of the institution. As far as Indian education is concerned, IIT's and IIM's have proven the top class institutions, not only because of the resources and atmosphere available for research activity but the interest of the institutions and the faculty members in the area of research and case study activity.

WAY TO OVERCOME THE SHORT COMINGS

The solution lies in creating awareness of research activity at all levels of academic process. The details of which are presented below [7,8]

A. Research Process Awareness and

B. How Research Experience Qualifies and enrich teacher in the Subject Knowledge.

A] RESEARCH PROCESS AWARENESS

Research process has not given much attention at UG level engineering courses. Awareness can be imparted to any P.G./U.G degree holder of Engineering & Technology by developing training programme. The training programme should be useful to an engineer working in manufacturing industry/ service industry/ educational institution etc. The training programme can have steps stated below.

Step 1: Study of Research Process

(a) Research Concept, Different types of research tasks, criterion of classifying research tasks, phenomena, general logic for analysis of results, hypothesis and theory.

(b) Approaches to identify new research tasks based on Literature Review, Field Study / Industry Observation, Extension of Executed Research.

(c) General Procedure of Execution of

1) Conceptual Research

2) Theoretical Research

3) Analytical Research

4) Applied Research

(d) Psychological factors having strong influence or research progress of an individual research worker

(e) Psychological process of understanding any new high level piece of literature totally on one's own (without taking help from teacher) i.e. how to grasp faster and more

Step 2 : Identification of New Tasks

Next step may address the detailed approach to identify individual discipline wise new research tasks i.e. Electronics Engineering. / Electrical Engineering / Mechanical Engineering / Computer Science & Engineering / Civil Engineering / Chemical Engineering and all others.

Step 3 : Mathematical Modeling

The course may then be oriented towards Mathematical Modeling (various types of

modeling : logic based / experimental data based / field data based), Model Optimization / Model Reliability, Modeling by Artificial Neural Network, Fuzzy Logic, Genetic Algorithms etc. which can give an investigator exact simulation of studied phenomena by mathematical equation.

B] INFLUENCE OF RESEARCH ON QUALITY OF TEACHING

The important aspect of quick and complete understanding a new piece of literature will certainly enhance teaching ability of a teacher. *He who knows the process of growth to the knowledge, is best to deliver the knowledge.* Hence, it is strong belief that research activity and teaching activity are interwoven and are necessary to become effective teacher [9].

CONCLUSION

Research based teaching will certainly help in building the confidence of the teacher for the teaching process. Latest input on technological development can be covered as a part of syllabus. Organization will be known for research and value added teaching process. The overall benefit will go to all the stakeholders of the educational institute mainly to students, teachers, management, industry and parents.

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