5. RESEARCH ORIENTATION TO ENGINEERING EDUCATION

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Abstract

This paper describes the present status of main feature of teaching-learning process i.e. (1) Classroom teaching (2) Deducing there from the present shortcomings of this process (3) subsequently it crystallizes necessary steps to overcome the shortcomings and finally (4) How involvement of a teacher in a research activity helps him in becoming a qualified teacher in a real sense of the term.

1. PRESENT STATUS :

There are many teaching learning processes. Amongst which the most important is the class room teaching. There are several (5/6) categories of teachers based on experience and what is the present status of his preparation of lectures is enumerated below.

1.1 Very Junior Teacher (0-5 years experience after B.E /M.E. degrees).

- 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 his performance based on response of students with regard to degree of silence maintained by students.

1.2 Middle Level Teacher (with 5 to 10 years experience)

- Subject is understood.
- No rehearsals needed.
- Only thinks about main points to be covered and their sequence.
- Adds very little about various applications of subject matter.
- Does not incorporate any thing from speciality books/conference proceedings / Journals relevant to that day's topic of discourse, For example a teacher of Electrical Machines while teaching Torque – Speed characteristics of Induction Motor will restrict himself only to that of NEMA Class A/B Motors and shall not speak about class C/D Motors from some speciality book [1].

1.3 Senior Level Teacher (with 10 to 15 years of experience)

- Only thinks about main points to be covered and their sequence.
- Adds fairly good amount about applications.
- Adds something from speciality books/ conference proceedings / Journals. For example, while teaching a topic on cam mechanism, after having taught how to draw displacement cam angle diagrams for some motions specified in syllabus like parabolic/

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SHM / Cycloidal motion of follower the teacher should speak about it's applications in practice and should also speak about some other motions like elliptical cam / involute cam [2] etc.

1.4 Fairly Senior Teacher (with 15 to 20 years of experience)

- Thinks about main points to be covered and their sequence.
- Adds good amount about applications.
- Adds fairly substantial from speciality books / conference Proceeding / Journals / papers he has reviewed / thesis he has examined/ sponsored project reports for which he was principal investigator or team mate.
- Starts with interactive style of teaching for some topics.

1.5 Very Senior Teacher (More than 20/ 25 years of Teaching Experience)

- After covering syllabus part emphasis on Interactive sessions What could be approach for further development. How much of expected further development is achieved.
- What could be the obstacles in achieving further development e.g. in Civil Engineering while teaching Construction Method of ground plus one building, he talks about how subject Ergonomics can be inter woven. The point to be emphasized is how present method of manual shoveling of Concrete Mixing Process can be improved by intermixing subject Ergonomics [3].

2. PRESENT SHORT COMINGS :

Ideally what is expected is to reach the 5th stage gradually in at least first 10 years after commencing teaching may be with the background of Master's Degree.

3. RELEVANCE OF RESEARCH AND TEACHING

This is presented in two stages namely, 3.1 Awareness of Research Process [4] and 3.2 How Research Experience Qualifies Teacher in Achieving this objective.

3.1 Awareness of Research Process :

Awareness of process of Research can be imparted to any P.G./U.G. degree holder of Engg. & Tech. by developing a training programme comprising of about 15 lectures each of 1 hour duration. This training programme could be useful to an engineer working in an Educational Institution / Industry. This training programme can have below stated three modules.

Module 1 : Presentation of Total Research Process :

In first four lectures what could be covered is as follows :

(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 : Literature Review Based, Field Study / Industry Observation Based, Extension of Executed Research. In literature review based approach of identifying a new research proposal the emphasis can be laid on (1) various literature sources (2) how to understand a latest research paper pertaining to proposed area of research published in International Journal of highest academic & professional standing. It is very difficult to accomplish this in a shortest possible time. This is what is to be emphasized based on basic principals of psychology of learning process [5]. (3) How to critically examine the paper from the point of view of crystallizing short comings of the paper which may become topics of future 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 covering fundamentals like (1) Innovation (2) Intution (3) Thinkers Tool Box (4) Creativity (5) How to Trigger Creativity [5] in solving problem at hand.

(e) Psychological process of understanding any new high level piece of literature totally on once own (without the aid of a teacher) i.e. how to grasp faster and more.

Module 2 : Approach of Identification of New Tasks individual discipline wise:

Next three lectures may deal with the detailed approach to identify individual discipline wise new research tasks i.e. Electronics Engg. / Electrical Engg. / Mech. Engg. / Computer Science & Engg. / Civil Engg. / Chemical Engg and all others.

Module 3 : Mathematical Modelling :

The course may then be oriented towards Mathematical Modelling (various types of modelling : logic based / experimental data based / field data based), Model Optimization / Model Reliability, Modelling by Artificial Neural Network, Fuzzy Logic, Genetic Algorithms which can give an investigator exact simulation of studied phenomena by mathematical equation. This complete portion may be covered in eight lectures.

3.2 Influences of Research Experience on Quality of Teaching.

While detailing the approach of identification of a new research task Literature Review Based emphasis is laid on how an investigator should study a new piece of literature totally on his own. If this quality is imbibed in an investigator, then he becomes completely self reliant in identifying new research task. Based on his average intelligence which any engineering/technology graduate possesses can even get a clue to solution of the problem. This in-fact is the whole crucks of initiation, development and reaching terminus of any research activity.

Off this process, the most important aspect of how to understand a new piece of literature total on once own very quickly and with completeness is in the opinion of the author is exactly what is required in elevating teaching ability of a teacher. This is the relevance of research activity and teaching activity. Hence, the author strongly believes that research activity and teaching activity are interwoven and are very necessary to become very effective teacher. *He who knows the process of growth to the knowledge he only is qualified to deliver knowledge [1].*

Investigator's ability to comment on present shortcomings of technology gets enhanced which is bound to be reflected while doing UG/ PG teaching in summarizing as regards new theory taught, it's shortcomings and approach to further development. Such aspects should be involved in UG/PG teaching in order to turn out a complete new technologist.

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