A NOVEL APPROACH FOR QUALITY EDUCATION TOWARDS INDUSTRY EXPECTATIONS

By

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ABSTRACT

This paper presents a new method to improve the quality in technical education in order to meet the industry expectations. The quality of education and training being imparted in the technical education institutions varies from excellent to poor, with some institutions comparing favourably with the best in the world. Few others are suffering from different degrees of faculty shortages infrastructure deficiencies, curricula obsolescence, lack of autonomy in academic, financial, administrative, and managerial matters poor involvement in knowledge creation and dissemination. Skillful manpower of high quality can play a major role in economic development and in export of technology and services, and observing the growing demand for Indian professionals particularly in the area of software and core engineering in all parts of the globe including the highly developed countries. It is necessary to give very high priority in providing quality technical education for Engineering and Technology. In order for the students to succeed, its necessary to prepare themselves for the ever changing world of work, which means not only college readiness, but also career readiness.

Key words: Pedagogical Knowledge, Contextual Knowledge, Learning Resources, Brainstorming and Pilot testing.

INTRODUCTION

Since Independence in 1947, Technical Education System in India has grown into a fairly large-sized system, offering opportunities for education and training in a wide variety of trades and disciplines at certificate, diploma, degree, postgraduate degree and doctoral levels in institutions located throughout the country. In the year 1947-48, the country had 38 degree level institutions with intake capacity of 2,500 and 53 diploma level institutions with intake capacity of 3,670. The intake for postgraduates was 70. There was rapid expansion of the system in the next 20 years. In 1967-68, the number of degree level institutions had increased to 137 with intake capacity of 25,000. In the next 10 years, the system capacity increased only marginally to admit 30,000 students for degree courses (Anandakrishnan, M. (2006).

The system capacities have increased very rapidly in the 20 years, with the major role being played by the private sector. By 1997, the system had 547 degree level institutions with admission capacity of about 131,000. Admission capacity for postgraduate courses had increased to 16,900. Out turn of doctorates were about 370 annually. In the year 2006, the total number of engineering institutions, not including the IITs (Indian Institutes of Technology), NITs (National Institute of Technology) and university colleges rose to 1518 with admission capacity of 5,69,283 students. Approximately, 2/3rd of these institutions were in the private sector. Now, in the academic year 2010-11, there are 3241 Engineering colleges with total intake capacities of 13, 24,246.

The Indian Economy is helped greatly with the availability of strong talent in Information Technology (IT). Since IT is pervasive in all fields of technologies and India being the hub in this sphere, the present situation has created much larger avenues of education and training. To meet the existing demand, a large number of private self-financing institutions were established in the country in the last ten years, mostly catering to IT industry which has now reached a saturation point and creating the problem of sustenance of those institutions.

The management of private institutions lacked vision and expertise to adjust their curriculum to suit the changing needs efficiently and effectively and hence they are unable to maintain the world standards in education. Government institutions, on the other hand, have so far survived due to public support. The institutions can no longer survive with obsolete knowledge among teachers, old curricula, obsolescence in the laboratories and workshops and wide spread in differences to the needs of the industry (Ball et. al 2007).

The need for skilled manpower to cater to the changing technological needs is attracting Multi National Companies to invest in the country (Emmer et.al 1994), (Government of India 2005). Along with sound technological skills, today's technocrats need sound management skills to survive. The ability to take tough decisions, be a motivating team leader, understanding the market behavior and orienting it to his/her advantage, are some of the key attributes of successful managers.

For the improvement and further development of the system, it is necessary that there is interaction between technical institutions and industry and other field organizations. But the current scenario is not sufficient to cater to the needs of industry. This attitude has to be changed radically in both technical institutions, who produce manpower for the industry and the field organizations, and also the latter themselves who are partners in the same enterprise of developing the economy; and it is high time that this responsibility is duly realized by setting up the interaction.

The employing sector should go out to associate and involve itself in all matters of technical education, planning and implementation (Borich, G.D.1996), Bybee et.al (2006). On the other hand, the technical education system should make this possible by appropriate incentives and safeguards for such involvement by personnel from the industry and employing organizations.

In order to cater to the needs of the industrial expectations, students should have an ability to apply knowledge of mathematics, science and engineering, an ability to design and conduct experiments, as well as to analyze and interpret data, an ability to design a system, component, or process to meet desired needs, an ability to function on multi-disciplinary teams and ability to identify and ability to solve engineering problems.

Prior Work

Faculty Development

The following are the suggested activities to develop the faculty for the promotion of academic excellence (Grasmick, N. S. 2006)

- Development of capacity for planning curricula to suit current and anticipated labor market requirements for both existing courses and new tones that might be introduced.
- Upgradation of competence in knowledge and skills in specified area(s) for better teaching at Under Graduate/Post Graduate levels.
- Use of innovative instructional methods and approaches.
- Designing and developing learning resources.
- Managing systematic reforms like institutional autonomy, program flexibility ,interaction with industry and community, developing appropriate cost recovery systems, improving utilization of institutional resources, and the management of institutions (Gray, R.C. and Smith,W.H.1998).

Technical and Support Staff Development

The training of staff may cover areas like exposure to industrial technology and processes, laboratory and workshop instruction, maintenance of laboratory and workshop equipment and computing facilities and upkeep of institutional services etc (Joshi 1998).

Equipment and facility improvement

Modernization and upgradation of laboratories, creation/ improvement of instructional facilities, creation of labs and workshops for new courses in emerging technology, creation and improvement of computing facilities and creation of R&D Facilities are needed for equipment and facility development (NIEPA 2000).

Curriculum Improvement

To enhance knowledge in accordance with the current scenario, the curriculum (Carnoy, M. 2006) needs to be

based on periodic updating and improvement of curricula of labour market-orientated course offering

- Innovations in curriculum development which include competency based curricula, self-learning, problem solving – projects for community and industry, training in industry, sandwich programs, learning by research, course flexibility etc,.
- Incorporation of problem solving skills, design skills, communication skills, entrepreneurial skills, information processing, creative and innovative thinking, leadership skills, work ethos etc which are need to be periodically updated.

Curriculum Implementation

To implement the curriculum, it is complex because of diversion in many streams and hence to simplify this process, the system must be unique with the iintroduction of variety in learning process, training of teachers in the use of variety of instructional methods and material, such as planned student visit and training in industry, expert lectures from industry, problem solving projects, student self-learning, introduction of system of continuous assessment, peer review and feedback from students, projects and services to be extended to community (Luca and Oliver 2001).

Student Evaluation

The following techniques can be carried out to evaluate the students and precede the path for institutional development (Davenport, T. H. 2005) (Chesbrough 2006),

- A well-defined system of comprehensive regular and continuous assessment to be developed to include regular tests, laboratory work, assignments, student self-learning, and student training in industry.
- Innovative assessment designs for competency development, and adherence to good practices in the field of service to industry and community, research activity, use of safety practices, environmental concerns and leadership and group work.
- Reduction of emphasis on terminal assessment in both regular and continuing education programs.

Learning resources

The teachers can learn (Davenport, T. H., & Harris, J. G. 2007) by the establishment of Learning Resource Development Centres or Education Technology Cells, establishment of Learning Resource Utilization Centres – facility for one to one usage of LRs, development/procurement of learning resources such as video films, multimedia and CAI (Computer Aided Instruction) packages, other learning resources such as laboratory manuals, learning packages and packages specific for the development of competencies, training of teachers in development of learning resources, creation of Learning Resources (LRs) storage facility for ready access to teachers and students and acquisition and installation of appropriate hardware for class room projection and self-learning from audio-visual resources (Harris, P. R., & Harris, K. G. 1996).

Interaction with industry

The institution can take steps to interact with the industry for the following purposes,

- Identification of employment opportunities for graduates through interaction with apex industry organizations (Kapur, D. and Mehta, P.B. 2004) (Eide et.al 2002).
- Contribution to curriculum development and delivery.
- Contribution to internal revenue generation.
- Contribution in governance of the institution.

New Methodology

Engineering Pedagogy

The faculty should have the pedagogical content which is the combination of subject matter knowledge,

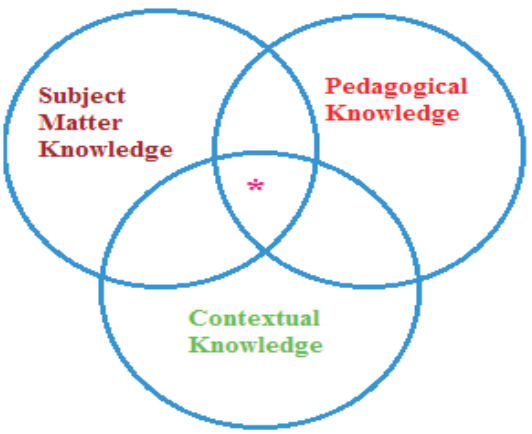

Figure 1. Pedagogical Content

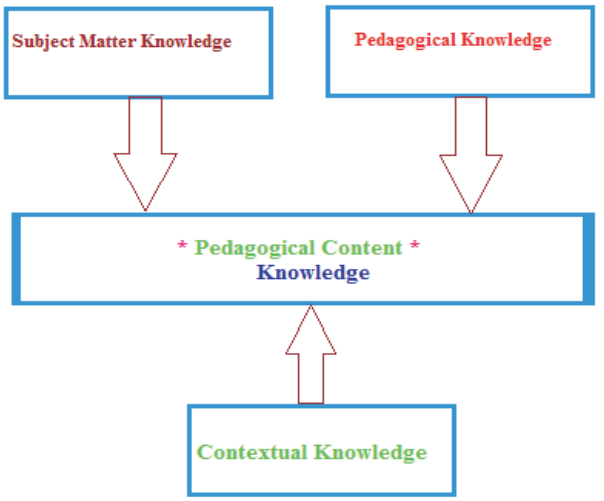

Figure 2. Needs of Pedagogical Content

pedagogical knowledge and contextual knowledge as shown in Figure 1.

Figure 2 shows the various parameters to meet the needs of the pedagogical content and to fulfill the engineering expectations.

Personal and professional attributes of a good teacher

A good teacher should have the willingness to share skills, knowledge, and expertise, demonstrates a positive attitude and acts as a positive role model, takes a personal interest in the mentoring relationship, exhibits enthusiasm in the field, values ongoing learning and growth in the field, provides guidance and constructive feedback, respected by colleagues and employees in all levels of the organization, sets and meets ongoing personal and professional goals, values the opinions and initiatives of others, and motivates others by setting a good example.

Preparation of Course and Lesson plan

For basic course work, where relatively simple and straightforward problems are to be solved, a simple eight-step sequence will suffice as follows

- Identify and fully define the problem.
- Research on previous solutions to similar problems.
- Brainstorm on possible solutions.
- Select the best solution.
- Build a working model (prototype).
- Test the working model.
- Adjust configuration as required to meet design goals.
- Demonstrate the document, and communicate the solution.

Lesson planning requires the ability to clearly visualize the laboratory or classroom, complete with all instructional aids, demonstration equipment, chalk (or white) board, and hand out materials, the students, and the instruction to be presented.

Well-integrated instruction and continuity from session to session are essential. Using a workable outline or lesson sequence is necessary to ensure that all aspects of a lesson or series of lessons are included. For this point, the groundwork is laid for the delivery of comprehensive instruction.

An effective format is the '5E plan' whose major components are: Engagement, Exploration, Explanation, Extension, and Evaluation.

This framework accommodates inclusion of science theory, application of mathematics skills, relevant environmental and social issues, history of the problem chosen for solution, economic influences, related career opportunities, and other topics considered applicable to the task at hand.

A more inclusive and detailed model may be required for advanced course work where project activities are more complex, and call for extensive research, experimentation, and a significant degree of specialization are accomplished. Other facets of engineering design may be introduced to increase rigor and relevance.

Team building

Teamwork is defined by Scarnati as a "cooperative process that allows ordinary people to achieve extraordinary results". Harris also explain that a team has a common goal or purpose where team members can develop effective, mutual relationships to achieve team goals. With the shift from a predominately instructivist to constructivist pedagogy, the need for tertiary educators to use a variety of teaching strategies and methods is becoming increasingly important. Learning designs need to incorporate student-centered team-based learning pedagogy such as project-based, case-based, inquiry-

based and problem-based scenarios.

The successful attributes needed for effective teamwork are as follows:

- *Commitment to team success and shared goals*
  Team members are committed to the success of the team and their shared goals for the project. Successful teams are motivated, engaged and aim to achieve the highest level.
- *Interdependence*

  Team members need to create an environment where together they can contribute far more than as individuals. A positive interdependent team environment brings out the best in each person enabling the team to achieve their goals at a far superior level. Individuals promote and encourage their fellow team members to achieve, contribute, and learn.
- *Interpersonal Skills*

  Includes the ability to discuss issues openly with team members, be honest, trustworthy, supportive and show respect and commitment to the team and to its individuals. Fostering a caring work environment is important including the ability to work effectively with other team members.
- *Appropriate team composition*

  It is essential in the creation of a successful team. Team members need to be fully aware of their specific team role and understand what is expected of them in terms of their contribution to the team and the project.
- *Commitment to team processes, leadership & accountability*

  Team members need to be accountable for their contribution to the team and the project. They need to be aware of team processes, best practice and new ideas. Effective leadership is essential for team success including shared decision-making and problem solving.

Project works Plan

A project work plan is an outline of the set of goals and processes by which a team or person can accomplish

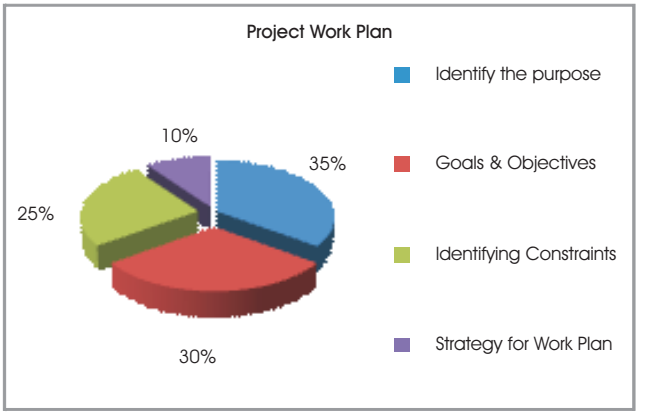

Figure 3. Project work plan chart

those goals, offering the reader a better understanding of the scope of the project. Work plans will help to stay organized while working on the projects. Work plans break down a process into small, achievable tasks and identify the things which need to be accomplished. Figure 3 shows the probability of the project work plan.

Identify the purpose for work plan

Work plans are written for various reasons. Most work plans are for a certain period of time (i.e., 6 months or 1 year).

- In the workplace, work plans help the supervisor to know what projects are to be undertaken over the next several months. These often come right after an annual performance review or as teams undertake large projects.
- In the academic world, work plans can help students to create a schedule for a large project.

Introduction and Background

For professional work plans, there must be an introduction and background. These provide the supervisor with the information they need to put the work plan into context.

- The introduction should be short and engaging.
- The background should highlight the reasons for creating this work plan. For example, recite details or statistics from recent reports, identify problems that need to be addressed, or build-off of recommendations or feedback that were received during previous work projects.

Determining the Goal(s) and Objectives

Goals and objectives are related in that they both point to

things that are hoped to be accomplished through the work plan.

Goals should focus on the big picture of the project. List the desired ultimate outcome of the work plan. For example, the goal is to complete a research paper or to learn more about writing.

- Objectives should be specific and tangible.
- Many work plans break down objectives into short, middle-, and long-term objectives
- Objectives are generally written in the active voice and use action verbs with specific meanings (e.g. "plan," "write," "increase," and "measure") instead of verbs with vaguer meanings (e.g. "examine," "understand," "know," etc.).

Ordering the work plan by "SMART" objectives

SMART (Specific Measurable Achievable Relevant Time-bound) is an acronym used by individuals searching for more tangible, actionable outcomes in work plans.

- ***Specific***- What exactly are we going to do for whom?
- ***Measurable***- Is it quantifiable and can we measure it?
- ***Achievable***- Can it be get done in the time allotted with the resources available?
- ***Relevant***- Will this objective have an effect on the desired goal or strategy?
- ***Time bound***- When will this objective be accomplished, and/or when will it be done?
- List the resources including anything that will be necessary for you to achieve your goals and objectives. Resources will vary, depending on the purpose of your work plan.

Identify the Constraints

Constraints are the obstacles that may get in the way of achieving the goals and objectives. For example, while working on a research paper for school, make sure that schedule is not too crowded to allow you to research and write properly. Therefore, a constraint would be the overwhelming schedule, and need to cut something out during the semester in order to complete the work plan effectively.

Write the Strategy

Looking over the work plan and deciding on how the resources will be used and overcoming the constraints in order to reach the goals and objectives.

- ***List specific action steps***- Identify what needs to happen each day or week for one to complete the objectives. Also list steps that other people in the team will need to take. Consider using project management software or a personal calendar to keep this information organized.
- ***Create a schedule***- By creating a tentative work schedule, realize that unexpected things might happen and those arises need to build a some space into the schedule to prevent from falling behind.

Commitments of the Institutions

The main commitments of the institution to enhance the quality of teaching is to support student learning (initiatives which will help students to work efficiently), feedback loop of the quality teaching initiatives on the teaching experience, support to students like counselling service, career advice, mentoring and students association, support to teaching and learning environment like libraries, computing facilities and virtual learning environment, management of programmes at institutional level, support to organizations, management of programmes at teachers level, prize endowment for good teachers or remarkable quality teaching initiated by teachers, funds to promote motivational teaching and professional development to pedagogy (pedagogical tools, teachers, behaviour and attitudes).

Suggested Contributions from industries to institutions:

The following are the suggested contribution by industries to institutions.

- Participating in curriculum design, curriculum implementation, student assessment, training of students, exposing students to new technologies, and providing experts for certain instructional sessions.
- Providing opportunities for student groups to undertake problem-solving projects.
- Participating in bodies such as the Board of Governors, Academic Council, Boards of Studies, Faculty

Recruitment Committees, etc.

- Assisting institutions in establishing new laboratories, providing literature on new technologies, and offering their shop floors as substitutes for laboratories.
- Training teachers and staff in new technologies and processes.
- Providing industrial training to students.
- Collaborating in sandwich programme offerings.
- Investing in creation of Interface Training Centers (ITC) or finishing schools.
- Involving institutions on sole or collaborative basis in R&D activities.
- Utilizing institutional resources (manpower and physical) for industrial manpower training.
- Development of Post Graduate Education in areas of current and potential high demand.

Discussion and Conclusions

With the great scope of technical education to meet the industrial expectations, there is a diminution in the placement scenario. Henceforth, this is a right break through to accelerate the concepts to improve the quality of technical education and to nurture the minds of budding engineers.

"Change" is the root cause of success in every aspects starting from movies to sports, family to politics, education to industrial prospects which leads to a healthy environment for the development of quality education with industrial expectations.

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