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Fostering freshman Engineering students in private colleges towards a result oriented future - An Indian Perspective

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Abstract. The past twenty five years has propelled India as an emergent economy and, in order to drive this growth, Engineering Education has taken a prominent place with the creation of more than three thousand colleges and several hundred more in the planning stage. However, the Industry laments the absence of trained and qualified engineers, stating its concern about the quality of the large numbers of graduates passing out from engineering institutes. In this paper, we analyze the common reasons that ail privately managed engineering colleges in India. They are categorized under Methods, Skills, Manpower, Tools-curricula, Environment, Policies and Layouts. Both Strategic and Operational issues are highlighted and a few immediate operational issues that can be easily managed by an Institution are taken up. The immediate solutions we suggest through this paper are the Semester Plan for study and continuous assessment, presentation guidelines for class lectures, course aligned with outcome as an effective pedagogic methodology and improvement of English proficiency. The suggested solutions for first-year students have been successfully implemented in an Institution and have shown significant improvements in student performance.

Keywords: Ishikawa Diagrams, Constructive alignment, Semester plan, Communication

1. Introduction

Soon after achieving independence in 1947, India sanctioned the intake of 2,500 students for engineering education across the nation. [1]. In the six decades since then, India has witnessed intakes of more than 8,00,000 students from various engineering Institutes under the supervision of more than 500 Universities. The global demand for engineers and the opening up of several multinational companies within India have played a significant role in creating the high demand for graduate engineers [2]. A 2005 McKinsey Global Institute survey of corporate human resource managers revealed that while 80 percent of US engineer graduates were globally employable, just about 25 percent of the Indian engineers were similarly employable [3]. Several reasons have been quoted in literature for the poor quality of engineering graduates and some of them include for instance, the Indian engineering education market, particularly the private institutions which are driven largely by economic considerations and administered solely for profit in spite of legal prohibitions. The present situation then makes it extremely important to review the state of engineering education in India and to determine means to improve the process.

In this paper, we have analysed the key factors responsible for ailing the private engineering institutions in India. The key factors that require changes have been categorised and are; methods for improving the quality of education, policies of Government and University, skills to be corrected and implemented, tools and curricula, environment for quality education, efficient manpower and finally a conducive location and

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layout. Taking these key factors into account, private engineering institutions can be suitably changed for the better with the necessary reforms in place.

Further, we have categorised the important key factors related to private engineering colleges on an operational and strategic perspective, and point out the measures required to improve the present scenario of these institutions. While most of the strategic issues require the purview of the Government and overseeing University, some of the Operational issues can be managed at the Institute level. We have identified issues that come under the purview of the Institute and those that require immediate attention. The solutions put forward namely the Semester plan for study and continuous assessment, Presentations for class lectures, Course aligned with outcome methodology and improved English proficiency have been implemented in an engineering institution and the students have shown significant performance improvements.

2. Analysis: What ails Indian Engineering Education in the Privately Managed Colleges?

We analyzed the state of education in Indian private engineering colleges and made an attempt to further categorize each of the reasons for the poor quality of education. For the purposes of logical clarity in depiction, Ishikawa Diagrams were used as shown in Figure 1 and we portray the issues along seven key factors affecting the same namely: Methods, Skills, Manpower, Tools-Curricula, Environment, Policies and Layouts. In view of the scope of this paper, our analysis is restricted to the most important issues.

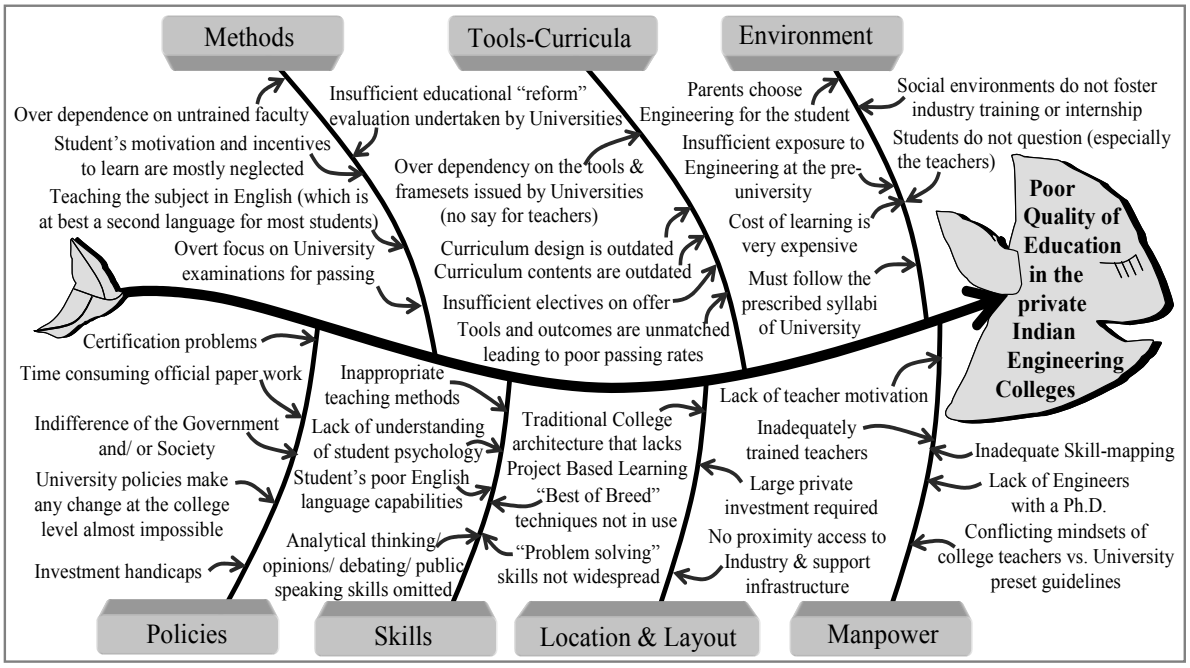

Fig. 1: What ails Indian Engineering Education in privately managed colleges?

Owing to the lack of adequate resources (financial and human) and the administrative efforts involved, it is a huge challenge to address all the issues identified in Figure 1. In essence, we can delineate the matrix along Strategic or Operational issues as depicted in Figure 2. A glance reveals that the strategic issues are either under the purview of the overseeing University or are purely external criteria which cannot be immediately influenced for change. From the Operational perspective, particularly bearing in mind those which can be addressed at the college level, we have selected a few key issues. The task is then simplified to doing all of the following:

- Improve upon the student focus on University held examinations
- Improve the student's ability to understand the course subject matter in English and to write effectively.
- Use some of the modern theories in student-teacher engagements ("Best of Breed" techniques).
- Enabling tools/ methods such that teaching methods and student's learning outcomes are well matched.

- Improve upon the student's ability to question, understand and respond to peers or teachers and keep the student well motivated to learn.

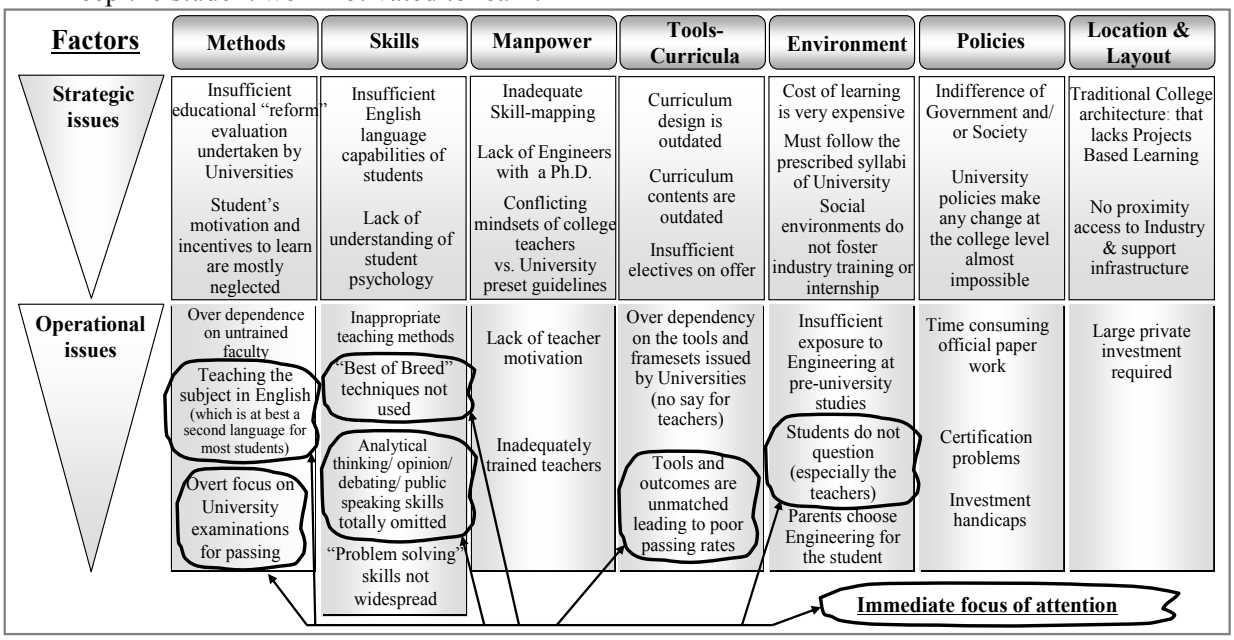

Fig. 2: Viewing issues from a Strategic and Operational perspective

3. Towards Re-genesis

By conducting regular workshops and holding effective class study sessions during the first-year of engineering education, we increase student motivation, help in further clarifying the relationship between the theoretical and the practical aspects of engineering, thereby leading to better success in future careers for the students. We digress here to state that the teaching modes and instructions for about eighty percent of the undergraduate programs in engineering colleges are controlled by the Universities (The Universities have the power to grant affiliation to such colleges). The Universities prescribe the courses, set the standards for the colleges, conducts the final examinations and awards the degrees. This obviously restricts the flexibility of the teachers in the use of teaching methods and content as well [4]. To overcome this, the first and foremost requirement is that the students remain constantly motivated and the teaching process is based upon John Biggs constructive alignment. Accordingly, the teacher's intention, student's activity and exam assessment outcomes have to be aligned with each other [5]. An aligned course then matches the teacher's intention with the "examination's assessment" while the student's interaction and activities help the student in dealing with the assessment exams. The teachers need to adopt the process of formulating intended learning outcomes to the existing University course syllabi based on the principles of Constructive Alignment [6].

Given the unique nature of the Indian school education environment, most students enrol in the private Engineering Colleges as dependent learners and accordingly, rely upon their instructors to present, organize, and interpret knowledge. According to Perry's model [7], dependent learners have a dualistic world where every point of view is either right or wrong, all knowledge is known and obtainable from teachers and texts, and the students' tasks are to absorb what they are told and then demonstrate having done so by repeating it back. It then becomes the responsibility of the teachers to transition the students from the dependent stance to being independent learners; and make them realize that all knowledge is not necessarily known and that different points of view may come in shades of gray; and, that the student is tasked with acquiring knowledge from a vast variety of sources while subjecting the same to their own critical evaluation. The teacher also introduces the peer group as a powerful learning resource and thus, the students working with their peer group identify the relevant resources and distil the info, learn the ability to discern and thereby identify the cause or effect. The teacher will furthermore, formulate the learning objectives and criteria, then assess the extent to which the students can believe what they read, and learn from lecture classes and communicate this newly-acquired information to others (peers). Such teamwork should enable the students

to confront the technological and social challenges facing engineers and will help them acquire the communication skills that cross disciplines, cultures, and languages [8].

Despite the legacy of English in India, many of the students enrolled in engineering and technology courses in India do not necessarily have English speaking backgrounds. The first year engineering undergraduate curriculum for various engineering courses includes the subject of Professional Communication in English and the All India Council for Technical Education (AICTE) has designed and published the model curriculum for the first-year undergraduate programme in engineering [9]. Experience has revealed that the English communication course must be structured more methodically and objective manner. We duly submit that in view of time availability constraints for the first-year students, emphasis on written English (where English is the medium of instruction) be paramount.

4. The Approach

We have taken the following four steps as listed below to resolve the key issues identified in Figure 2.

4.1. The Semester Plan for study and continuous assessment

A visual Semester Plan for both the students and teachers helps them both to focus on the timing of events during the semester and to prepare themselves for the tasks. Figure 3 is a sample Semester Plan designed for the BTC college of Engineering & Technology. The five modules correspond to the division of each course. Students who fail/ fare poorly in the 2-3 week spaced class tests are tasked with attending the interactive class sessions where each student is asked to come in front of the class and answer questions posed by the teacher. The student response helps the teacher to align the lecture classes to the student's activity and the examination's assessment at large. This is an essential element for constructive alignment.

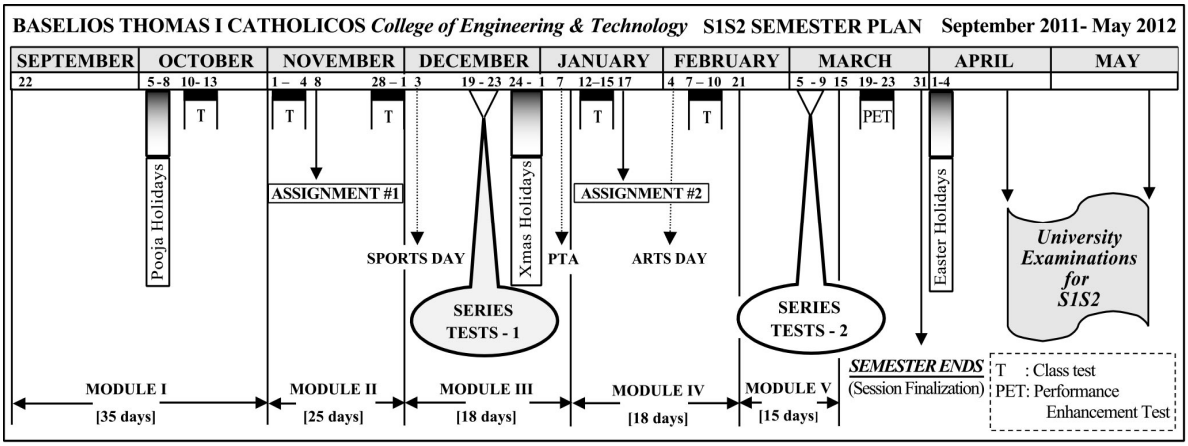

Fig. 3: Semester Plan at a Glance

4.2. PowerPoint presentation for each Class lecture

A well designed framework via PowerPoint presentation is used during each lecture class and this details the intent of the class, the key points/ words /formulae being used or demonstrated during the class, the lecture class summary and conclusion with examination questions at the end. The head of the Institution such as the Principal / Head of the Department, as a senior mentor reviews these presentations and content. The effectiveness of each presentation is evaluated and corrected periodically based upon the learning outcomes – especially from the interactive classes for those who have failed/ fared poorly in the class tests. Hence a continuous quality improvement measure is in place. The periodic revision is yet another essential element.

4.3. Course aligned with outcomes

In accordance with John Biggs' Constructive alignment theory [6], all the teacher activities, student's learning approaches and the educational outcomes being interactively related, the courses are thus aligned as depicted in Figure 4. Teachers also emphasize interactions with peers to learn faster and importantly outside the classroom. This continuous revision process is the third most important element in bringing out positive results. As a direct consequence of our alignment, the student learning outcomes have shown constant improvements thus proving nurturing is possible and the college can impact the students significantly.

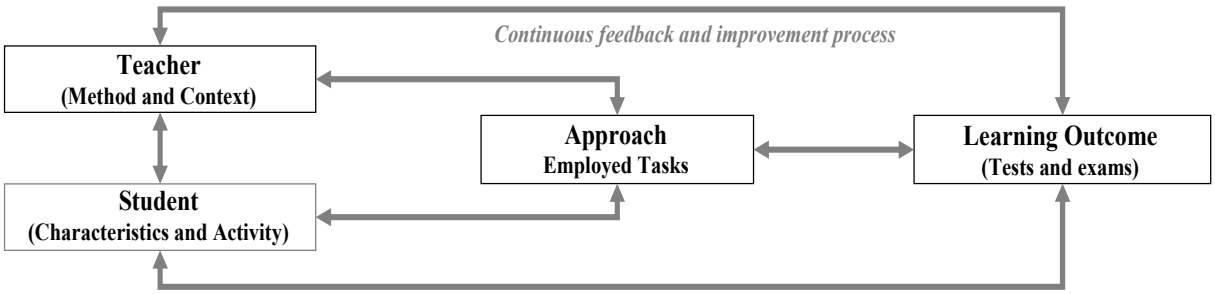

Fig. 4: Continuous Outcome Improvement Programme (COIP)

4.4. English Learning

We seriously emphasize the use of written English in the first year despite the time constraints for completion of a large number of prescribed technical courses and workshops in the study schedule. The English sessions also focus on spellings, use of connectivity words (utilizing engineering terms) and précis writing. For those very weak in English and her usage, we permit the usage of local/ regional language as needed for communication. This last element ensures that the student outcomes are positively charged.

5. Inference and Conclusion

The authors have put the above approaches to practice at the BTC College and the measures have demonstrated significant improvement in performance averages for the first-year students. The PowerPoint presentations in class lectures and the interactive classes held after the evaluation of class test results have helped the teachers to suitably tailor their teaching methods and context, while also motivating the students (who failed/ fared poorly) to improve upon their examination grades. The English classes have contributed to increased confidence and better written skills. We believe that our efforts are likely to pave the way to better student outcomes. Our immediate focus has been on first-year students and while the results are quite heartening and deeply revealing, we admit that much more needs to be done as depicted in Figure 2 for improving engineering education in India. We expect to publish more of our results as we expand our focus of attention and our scope.

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