

Academia-Industry Collaboration to improve the Quality of Teaching-Learning Process

Dr. M Dakshayini

Department of Information Science and Engg.
B M S College of Engineering
Bengalure, India
dakshayini.ise@bmsce.ac.in

Dr. P Jayarekha

Department of Information Science and Engg.
B M S College of Engineering
Bengalure, India
jayarekha.ise@bmsce.ac.in

Abstract—In traditional output-based education system, class room lecture and laboratory are the traditional delivery methods used during the course. Written examination and lab examination have been used as a conventional tool for evaluating student's performance. Hence there are certain apprehensions that the traditional education system may not efficiently prepare the students for competent professional life. This has led for the change from Traditional output-based education to Outcome-Based Education (OBE). OBE first sets the ideal programme learning outcome consecutively on increasing degree of complexity that students are expected to master. The core curriculum, teaching methodologies and assessment tools are then designed to achieve the proposed outcomes mainly focusing on what students can actually attain after they are taught. In this paper we discuss a promising applications based learning and evaluation component involving industry collaboration to improve the quality of teaching and student learning process. Incorporation of this component definitely improves the quality of student learning in engineering education and helps the student to attain the competency as per the graduate attributes. This may also reduce the Industry-academia gap.

Index Terms — Outcome-Based Education, programme learning outcome, teaching-learning process, evaluation, Industry collaboration.

I. INTRODUCTION

In traditional output-based education system, class room lecture, tutorial and laboratory are the traditional teaching methods used in a course [6]. Traditional Output-Based Education System is basically a content oriented model. Each education system that follows this model would have its associated syllabi and relevant contents are taught in the classrooms and experimented in the lab. Students are examined for the same by means of theory and practical examinations commonly based on understand, memorize and reproduce that was taught model.

Written examination and lab examination have been used as a conventional tool for evaluating student's performance. In this system student's learning ability can be tested maximum only at the understanding and design level and very minimum at the application level. Lack of importance was found on real time problem solving perception and soft skills that are needed

for jobs. Hence there was a need for a review of the traditional education system that was not satisfactorily preparing the students for competent professional life. This has driven for an implementation of the Outcome-Based Education(OBE) system with a hope of making the students competent enough to face the growing technically challenging world. OBE is a system in which, the ideal programme learning outcomes are set first then the curriculum, teaching methodologies and assessment tools are designed to accomplish the intended outcome. This system mainly focuses on what students have actually attained after completing the learning process[5]. This also focuses on their ability in problem solving skills by appropriate applications of learnt concepts in solving real life problems. Academia in collaboration with industry can set up real time applications based research environment. From this students can get better motivation and opportunity to work with real life problems and gain good amount of practical expertise and experience[9]. This may provide the better opportunity for research scholars also to take up and work with the changing problems.

II. EXPECTATIONS OF OUTCOME BASED EDUCATION

In OBE students are expected to be able to do more challenging tasks other than just understanding, memorizing and reproducing what they have learnt in the class room during the course. OBE expects the students to be

- more creative
- able to analyze and synthesize the concepts in the direction of application
- able to plan and organize tasks
- able to work in a team

Students are also expected to be able to

- write project proposals
- implement and complete the proposed projects
- analyze case studies
- think
- question
- do research and
- make decisions based on the findings.

These expectations of OBE from the students are projected as programme learning outcomes and are certainly a key to a meaningful education. Hence, It is essential to focus on setting right programme learning outcomes and motivating the students in attaining theses outcomes meeting the expectations of OBE. The perception of programme learning outcome is a complementary perspective that potentially provides us with a better understanding of how learning takes place, and what comes out of learning activities. Most of the educational decisions are made based on how best to facilitate the desired outcomes[4].

III. PROGRAMME LEARNING OUTCOMES



Fig 1. Bloom's Hierarchical structure of complexity of various levels

Programme learning outcomes are defined by considering the knowledge, skills, and competencies to be acquired by the students at the end of learning process[1]. Normally Bloom's taxonomy is used for writing programme learning outcomes as it provides a convenient structure and list of suitable verbs to define programme learning outcomes as shown in the fig. 1. This helps in determining the level of intellectual skills of the student assessing their performance[8]. The structure and the verbs defined in Blooms taxonomy helps to assess a measurable student outcome depending on the predefined objectives to which the programme learning outcomes are connected. Blooms taxonomy based programme learning outcomes thus provide direction for student learning activities and set down assessment techniques to measure attainment levels of the student.

The programme learning outcomes are set out sequentially on increasing degree of complexity that students are expected to master after the successful completion of the process of learning[3]. Programme learning outcomes mainly focus on what the learner(student) can demonstrate at the end of a learning process. Hence, assessment techniques and the tools must be designed to measure and report the student performance by means of acquisition of skills and competencies. Hence programme learning outcomes are considered as a result of learning process. These assessment tools must report as how much and how well the students have

learnt. If the academia in association with industry can provide a suitable platform for the students to demonstrate what they have learnt, students can apply their learnt knowledge and produce useful products. There may be some academically poor students, who may not be able to meet the expectations of OBE at the first level. They need to follow a different learning procedure defined for such students and finish later.

IV. NEED OF ACADEMIA AND INDUSTRY COLLABORATION

New technologies are being evolved rapidly and continuously, and students are ultimately going to work with these technologies in the industries after completing their learning activities in the college. So, the academic curriculum and academicians also need to be updated regularly to keep them be aligned with the development of the technology otherwise they are outdated. Also learning is a continuous process and hence frequent discussions must take place regularly with the industry experts and scientists for refining the curriculum on regular basis. Academic institutions can also consider the inputs and suggestion from the industry people regarding their perception or evaluation of the overall capability of their students(alumnus). In this process role of faculties also changes from making the students strong not only with the theoretical basics to preparing them to be able to handle more practically challenging tasks as well. For this, faculties should also be provided with training programmes and workshops in cooperation with industry experts to update themselves with the growing and changing technologies. This may help academia to successfully move along with the technically changing world.

Generally in most of the technical educational institutions, theoretical concepts are taught and executed at the laboratory level. In industry perspective, the laboratory validated concept must be transformed into an operable commercial product[7]. The Academic R&D in the country should actually be concentrated on this phase of technology development where laboratory models are scaled up and converted into commercially viable products/processes [2]. Students must be motivated to put their effort in evolving a laboratory-demonstrated idea into an implementable technology. In order to implement this collaborative scheme, a support system ensuring a focused involvement of both academia and industry is needed.

V. INTERACTION MODEL BETWEEN ACADEMIA AND INDUSTRY

Academia should give more importance for application oriented research work in interaction with industry. This may give better motivation and the chance for students to work with real time applications and meet the expectations of OBE. In this direction academia could set up research associations in collaboration with the industry. This can be done with a view of encouraging research driven technology development in-house and also in collaboration with the Industry[9].

There is a need to create an environment for a close interaction among academia and industry. Setting up of technology incubation centers in each department in the college campus can provide the students with good amount of practical expertise and experience that helps them to gain better attainment of the defined outcomes as shown in fig. 2.

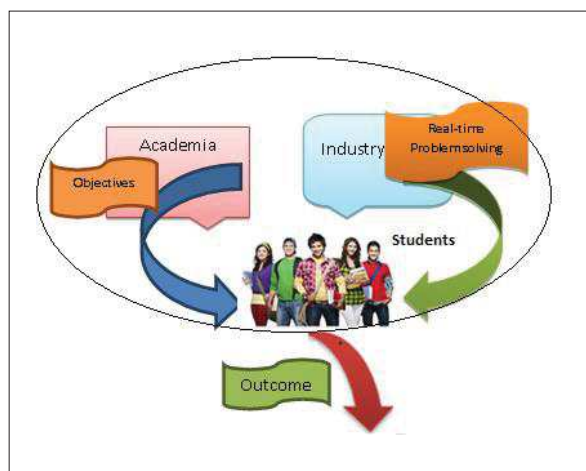


Figure 2. Collaborative Model between academia and Industry

A. Implementation

Academia-industry collaboration model can be implemented for all the courses of the programme. For each course, a separate forum(lab) must be setup and domain experts must be assigned from both the department and from the industry. The students should be guided in applying the theoretical concepts that they learn during the course in the direction of solving real life problems practically. In this regard, a set of projects/problems can be decided by both the domain experts that may help the students in solving real time applications by considering societal problems. Students should be guided by the experts from both academia and industry for the successful completion of the project according to the required metric of OBE.

B. Outcome of Academia-Industry Collaboration

Exchange of knowledge is always helpful in successful delivery of a project/product. Hence, the collective effort of both the academia and industry in establishing a meaningful association certainly achieves the following fruitful benefits.

- Short term training programs, workshops, faculty development programs and conferences can be done in interaction with industry
- Students can achieve better degree of attainment of outcomes with the gains in technical education, advanced technologies and practical competence

- Students gain an intense insight into the corporate world from the beginning of their engineering studies and a good understanding of the present technologies, challenges and management skills
- Job opportunities may be increased for the students
- Students can align their stream of studies to the actual requirements of the company, so that with minimum training they can get a good start in high-expertise jobs
- Training for their career begins at a very early stage of the graduation
- Good number of collaborative publications and patents can be achieved.
- Industries will also be benefitted to hire highly qualified graduates (ready for job) with the problem solving and core management skills
- The long term association and collaboration of academia-industry can result in a good quality products using cutting edge technologies and also at the reduced cost.

VI. CONCLUSIONS

In Outcome Based Education system, performance of the student is assessed based on his/her level of attainment of the outcomes. This is done by the demonstration of what students have learnt after completing the learning process. Hence, Academia and industry by jointly creating a real time applications based research platform in each programme can provide the students with better motivation and opportunity to work with real life problems of the society and satisfy the expectations of OBE. This collective effort of both academia and industry definitely achieves the fruitful collaborative learning improving the quality of teaching-learning practice in engineering education. Further, this also may help to reduce the Industry-Academia gap.

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