Role of Industry to improve Outcome Based Education in Engineering

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Abstract— **Industry Institute Interaction has different perspective and different reasons to interact with each other. Both are mutually benefited from this interaction. Academia is the main source of knowledge for industry. In general, role of Industry is an important factor for research and outcome based education in engineering institutions. Outcome Based Education is incomplete without successful interaction between Industry and Engineering Institution. This paper present the activities under MOU'S signed between BMS college of Engineering and other IT Industries. These activities aim to achieve the different Programme Outcomes.**

Keywords—Outcome Based Education, Programme Outcomes, Course Outcomes, Industry Institute Interaction, Memorandum of Understanding.

I. Introduction

As per Washington Accord, Outcome Based Education is the main focus to achieve the Quality of Education. With respect to this academy having collaboration with industry becomes an important factor. When industry institute collaboration increases, it facilitates research, internship, webinars, seminars, workshops, online courses, code competition, industrial visit, placement etc. to ensure it benefits students, faculties and all the stakeholders involved. Academia is the main source of knowledge for industry[1] and the collaboration has many innovations such as radical and incremental innovations[2].

In this paper we are discussing the best practices followed in our institution (Department of CSE/ISE, BMS College of Engineering) and we provide few case studies which are successfully applied to achieve OBE. This paper is organized in six sections. In first section we discussed about Curriculum Development, second section is about Value added course, third section is about Extension lecture series & Workshop, fourth section is about Industrial Visit, fifth section is about Internship and the last section is about Social Learning.

II. Curriculum development

In our college the members of Board of Study (BOS) include Faculties, Students, Alumni and Industry partners. The purpose of BOS meeting is to design the curriculum such that it matches the current trends as per the Industry requirement and the process to improve the curriculum design as shown in the fig.1[3].

There are number of courses in our department such as cloud computing, Storage Area Network, Building Enterprise Applications, Mobile Application development etc. These courses are based on the input obtained from the industry partners. The main objective of the curriculum design is Outcome Based Education, where in each course have many Course Outcomes (CO) and our department has 12 Programme Outcomes (PO) (as per Washington Accord) as shown in the Table 1 [3]. Our goal is to map each Course Outcomes with 12(Twelve) Programme Outcomes. Taking one of the course (cloud computing) as an example Table II shows the mapping of Course Outcomes and Programme Outcomes where a student is able to achieve this after successful completion of the course.

TABLE I.   LIST OF PROGRAMME OUTCOMES

PO 1	Ability to apply knowledge of Mathematics, Science and Engineering
PO 2	Ability to identify the problem and formulate the computing requirements appropriate to solutions
PO 3	Ability to design a system to meet desired needs
PO 4	Capability to conduct investigation on complex problem and solution
PO 5	Ability to use appropriate techniques, resources and tools
PO 6	Capability to identify and solve societal problems using computational techniques.
PO 7	Understanding the impact of professional engineering solutions in societal and need for sustainable development
PO 8	Understanding professional, ethical, legal, security and social issues & responsibilities
PO 9	Capability to work independently and as a team member
PO 10	Ability to communicate effectively
PO 11	Understanding of engineering management principles and apply this to work for managing the projects

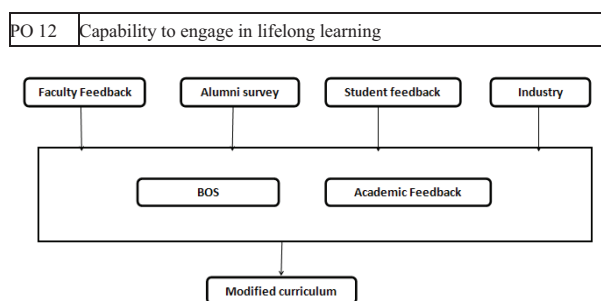| PO 12	Capability to engage in lifelong learning

Fig. 1. Process for improving Curriculum design.

TABLE II. MAPPING THE COURSE OUTCOMES AND PROGRAMME OUTCOMES OF CLOUD COMPUTING

Course Outcomes	PO 1	PO 2	PO 4	PO 5	PO 6	PO 7
CO 1: Explain various evolution of cloud computing.	H					
CO 2: Express benefits from Cloud Computing as an alternative to Conventional IT infrastructure.				L		
CO 3: Explain Software services.				L	L	L
CO 4: Describe Virtualization efforts in an Organization	H		L		H	H
CO 5: Identify best practices available: Amazon, Microsoft, Google, IBM and Sales Force and NetApp.		L				H

H –HIGH, **L**- LOW

III. VALUE ADDED COURSES

We have MOU'S with many Industry partners and there are many certification courses provided free of cost. They motivate students to take up the certification courses which add value to their degree. The outgoing engineers must be industry ready. The value added courses (certification courses) provides environment for the students in the current trend leading to technological skills expected by the industry.

We have MOU with EMC Corporation, the main goal of this EMC is to bridge the gap between industry and academia and produce industry ready engineers. There are many certification courses provided by the EMC such as Cloud Infrastructure services, Information storage management etc. where training to such courses are provided for faculty or student are absolutely free of cost. EMC provides the training on such courses. A trained faculty teaches the students with all necessary support from EMC Corporation to facilitate student to take up the certification exam for free of cost or very nominal fee.

Similarly value added course conducted by IBM experts on Rational Application Developer (RAD) Certification during Oct-Nov 2013 and it benefited around 75 students, where students got an opportunity to learn integrated development environment of RAD that helps java software developers design, develop and deploy their application.

We have another example where value added course was conducted on data structure for non-IT student in January 2013 by our department faculties. The non-IT student does not get the chance to work practically even though the subject is given as elective. Our approach was to give hands on experience to the student and conduct the practical exam, analyze the performance of the student by giving mini projects. The demonstration of the mini project is done in front of the panel with presentation. Course completion certificate is given to the student who successfully completes the tasks assigned to them. The outcome was very satisfactory based on the feedback.

The attainment of PO's with regard to value added courses are measured through Feedback from the student, Knowledge gain of course reinforce the concepts from industry perspective tested with the help of quiz and finally student take up Certification Courses exam. Certification exam are conducted by EMC Corporation. These certification courses have enhanced their employable skills.

IV. EXTENSION LECTURE SERIES & WORKSHOPS

In each semester our department conducts many extension lecture series to enhance knowledge of the student and faculties with current trends and technology. We also conduct workshop to have hands on session for students & faculties to learn new tools and technologies from various companies.

We organized a one day workshop on software testing for students of computer science cluster under the NOVELL MOU. Students were taught about automation testing and conceptual analysis. Demo sessions were conducted with selenium tool. Student realized the importance of testing in software projects, role and responsibilities of a tester profile. They were also exposed to the opportunities in testing carrier.

Extension lecture series also addressed professional ethics, which supplements the courses such as software testing, cloud computing.

V. INDUSTRIAL VISITS

Industrial visits enhance student practical knowledge and the challenges faced by the organizations in the business world. Industrial visits also give greater clarity about various technical concepts for students as they can practically see how these concepts are put into action.

As a part of improving Quality of Education, Industrial visits play an important activity in any engineering undergraduate programme that motivates student to achieve essential Programme Outcomes.

We had an Industrial visit to Infosys Bangalore campus, during the visit student were able to identify current technology usage in industry and list the current product developments of the Infosys.

Similarly, during visit to SAP Technologies Bangalore, student explored various products such as SAP HANA, short for "High-Performance Analytic Appliance" which is an in-memory, column-oriented, relational database management system developed and marketed by SAP SE [6]. Students registered for SAP Lumira contest and experienced the practical usage of it.

Once the industrial visit is completed, it is mandatory to each student to submit the report and record their experience which indirectly helped them to acquire the soft skills such as comprehensive report writing and technical skill and presentation through presentation. Though we have not allotted any marks this semester but planned to allot the marks in future. Also the current industrial exposure helped student in analyzing the requirement the project they are taking up in the current semester. The PO's attained through industrial visit are PO5, PO9.

VI. INTERNSHIP

Students have done many research based internship/project in industry. Based on that how Outcome Based Education is achieved by a student. They have done many projects in industry leading industry products.

Few of our students are doing the internship in CDAC Bangalore. The case study is on the ongoing project called "Risk Based Authentication System (RBAS)". The student before proceeding with the actual implementation referred journal and conference papers which helped them to understand the concept of Research based project.

In June 2014 Internship program was offered to students of CSE/ISE under MOU signed with NOVELL. Four students were shortlisted based on merit and offered internship for a span of 5 days. This was a unique opportunity for them to work on real time projects and understand the working process in IT industry. To utilize the summer vacation, learn skills of efficient coding, meeting deadlines, managing projects, working in team and ability to communicate effectively.

During industrial internship students are exposed to industrial practice, different tools, understand the professional, ethical and legal issues. After internship completion, the student submits the comprehensive report and presentation to fellow student. This report and presentation was valuated. PO's attained through internship in industry are PO5, PO7, PO8, PO9, PO10, PO11, and PO12.

VII. SOCIAL LEARNING

We are also achieving OBE through social learning and we are having MOU with wiksate. The activities under this are:

1) **Flipped classroom** *:* It Is a form of blendded learning in which students are invited to watch the video lectures, read the presentations, solve the assignments usually outside classroom. The Faculty will be the fecilitator in the the class room to solve more personlized guidance and interaction with students instead of chalk and talk. [4].

For example we have experminented this with wiksate tool[5]. The wiksate is a social learning platform where students are invited to watch lecture video,discussion on few topics,to solve the assignment problem etc.

2) **Alternate Assessment Tool** : Instead of assessing the performance of the student through only Internal Assessment Test, our department have implemented few alternate assessment techniques such as Quiz, Seminar, mini project which was successful in understanding the subject under OBE.

Through social learning students are exposed to virtual class room, learning management and online discussions. In social learning PO's attainments are measured based on the online activity such as likes Learn, comments, Share and active participation in the discussion. The PO's attained are PO1, PO2, PO3, PO4, PO5, and PO9.

VIII. ACTIVITIES UNDER MOU

Table III shows the MOU signed by our institution and its activities in our department.

TABLE III. MOU WITH ACTIVITIES

Sl.No	MOU with company	Activities
1	TCS	Extension Lecture Series
		Best Project award
2	EMC	Faculty Development Program
		Extension Lecture Series
		Internship
		Industrial Visit
		Certification Courses
3	SAP	SAP Techniversity India's Largest technology event
		Design Thinking
		SAP Lumira
		SAP APJ President Visit's BMSCE
		Design Thinking
		Industrial visit
		Code Jam focused on Java based development on SAP HANA Cloud Platform using Eclipse IDE
4	NOVELL	Faculty Development Program
		Extension Lecture Series
		Internship
5	Wiksate	Social Learning Platform

Conclusion

Outcome Based Education is not achieved by traditional method of taking class which is chalk and talk. There are many activities discussed in this paper which helps the student achieve the objective set by Washington Accord.

Acknowledgment

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[2] Report from an International Workshop on Academia-Industry Relations

[3] Sigtuna, Sweden, 22-25 November 2011 "Scientific Relations Between Academia and Industry: Building on a New Era of Interactions for the Benefit of Society"

[4] SAR NBA document of CSE department

[5] http://en.wikipedia.org/wiki/Flipped_classroom

[6] http://wiksateweb.cloudapp.net