Creation of an OBE Model PO Attainment Tool

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Abstract - This paper is focused on the strategy of outcome-based education (OBE) approach to boost the quality of education. This approach emphasizes on pre-defined attributes required in a graduate engineer. Based on evaluation of OBE, the attainment process of programme outcome (PO) is defined for qualitative education. To show that an outcome has been met, the OBE requires evidence of evaluation. An evaluation framework has been designed and developed by considering the engineering stream students. The tools of attainment are built by considering different parameters of the respective curriculum to measure the attainment of POs. In the OBE system, there is no single specified technique of teaching and assessment to achieve the specified outcomes.

Index Terms – OBE, COs, POs, PEOs.

I. INTRODUCTION

Outcome-based education (OBE) is a methodology for education that defines the expected final educational product, i.e. ability of the student's by calculating final program outcome. Within an OBE method, the faculty member's duty is to change as a mentor based on the targeted result. OBE begins with a simple view of what students should know, what is the ability to do, and what experience and skills they need at the end of the program completion. In an outcome-based approach, knowledge can be evaluated by the assessment tools. Therefore, in the implementation of OBE, a systematic process is to be followed, from planning to execution in phases [1].

In an OBE method, the learning results are defined and also represented by various accreditation and evaluation bodies. The method of achieving results can vary from one programmer to another according to the trainee and the programme. Therefore, the selection of assessment tool depends on the choice of trainee and program. In a well-defined OBE system, the attainment process should be systematic and understandable to all the students. The achievement will be measurable however, the some learners may take more time than others in the process of achieving the result. The OBE is not a trainer-imposed deadline-based system, it is a Lerner or student's based system. Therefore, in an OBE system, the trainer trained the students and offers to give the test until the candidate gain the mastery as demanded. Trainer encourages the students to give tests to achieve even higher mastery [2].

II. DEFINING PROGRAM EDUCATIONAL OBJECTIVES (PEOS)

The method used for Outcome-Based Education (OBE) is a teaching-learning approach, in that the teaching process shifted to learner or student-centric instead of conventional teaching-centric. The Lerner-centric approach focuses on the desired attributes should students possess after the completion of the program through the following program educational objectives (PEOs) [3].

- To provide students with solid engineering science fundamentals, with a greater focus on domain awareness through the analysis of engineering challenges.
- Provide students with the science and engineering skills they need to comprehend, interpret, design, and create new products and solutions to real-world problems.
- To instill a professional and moral demeanor, effective interpersonal skills, teamwork abilities, a multidisciplinary approach, innovative thinking, and the ability to identify with social issues.
- To provide students with a high-quality academic atmosphere in which they can develop leadership skills, written ethical codes and guidelines, and the self-motivated life-long learning habits that are necessary for a successful professional career.
- To prepare students for success in industry as well as in higher education by instilling strong moral standards and awareness in them.

The quality of teaching is determined in the OBE method by the student's quality of observable learning, which is defined as the attainment of the results of the program. The Program Educational Objectives (PEOs) are established to match the program's Vision and Mission. The Programme Outcomes (POs) are defined to attain PEOs, and the POs are further aligned with Course

Outcomes (COs) of the subject. The COs and POs are the short-term goals, while the PEOs, Mission, and Vision are the long term goals set to achieve by the program.

  PEOs are characteristics of program graduates that allow them to become successful professionals in their fields. Taking into account the program's constituencies and the college's mission, the department has recorded measurable PEOs for its Bachelor of Technology/Engineering program. The PEOs are created in accordance with the department's vision and mission statements [4].

  Figure 1 shows a flowchart of the procedures for creating and revising Program Educational Objectives (PEOs). The PEOs are based on the Institute's vision and mission, as well as the Department's and Graduate qualities suggested by the NBA/NAAC Accreditation Body.
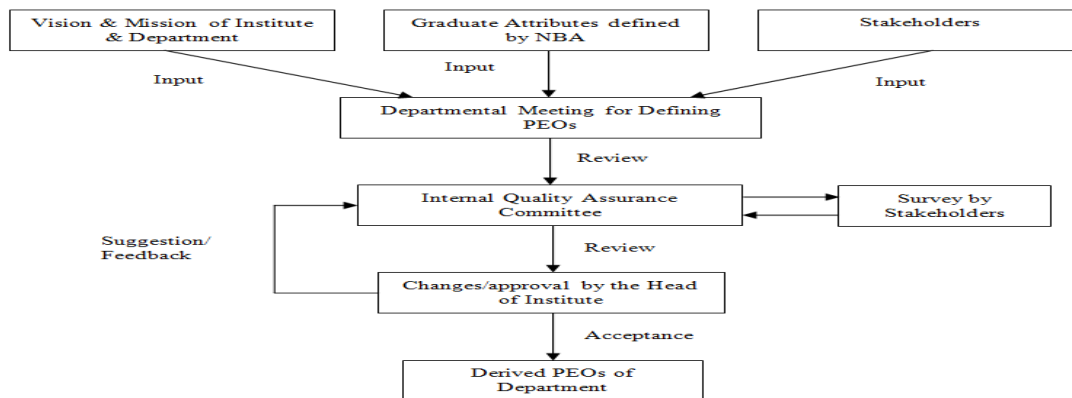

Fig. 1 Process for defining PEOs.

Stakeholder input is gathered through detailed surveys, with personal, telephone, or other appropriate follow-ups by the departmental head and related faculty members.

    Students, alumni, faculty members, parents, professional bodies, and industrial people may be stakeholders, and each course under the program has some specified course outcomes (COs) that highlight contribution to various POs leading to the eventual achievement of POs upon successful completion of the course. Fundamental principles, tools, and methods are given appropriate weight in each course, with an emphasis on practical implementations. This establishes a strong link between course outcomes (COs) and program outcomes (POs) in terms of developing necessary skills in students and preparing them to be competent engineers [5]. The whole curriculum is bifurcated into the following categories:

1. Basic science courses
2. Prerequisite of core courses
3. Core courses
4. Computing courses

The course components are measured directly in a quantifiable manner, which is connected to the curriculum, and the programme outcomes (POs) are mapped with the course outcomes (COs). Thus, by attaining the course outcomes, the programme outcome can be attained up to a certain level.

III. RUBRIC FOR ASSESSMENT TOOL OF POS

    The accreditation board defines program outcomes (POs) as the following graduate qualities.

1. Engineering knowledge
2. Problem analysis
3. Design/development of solutions
4. Conduct investigations of complex problems
5. Modern tool usage
6. The engineer and society
7. Environment and sustainability
8. Ethics
9. Individual and teamwork
10. Communication

11. Project management and finance
12. Life-long learning

The above POs would be attained through course curriculum and extra curriculum activities. The assessment tool for PO attainment is designed to calculate the quantitative value of attainment and it can also be used to find out curriculum gaps.

The PO attainment evaluation method is designed to measure and calculate the quantitative value of achievement and the curriculum gaps may also be find out from this method. Table-1 describes the evaluation method for one sample PO by considering the mapping of parameters into three categories: low (L/1), medium (M/2), and high (H/3). For each evaluation parameter, the rubric is also specified to measure the attainment value as below.

Rubric:
 a. P% students are getting marks greater than Q% marks, in this case, marks obtained will be 100% (3).
 b. P% students are getting marks greater than (Q-5)% marks, in this case, marks obtained will be 80% (2.4).
 c. (P-10)% of students are getting marks greater than Q% marks, in this case, marks obtained will be 60% (1.8).
 d. (P-10)% of students are getting the marks greater than (Q-5)% marks, in this case, marks obtained will be 50% (1.5).
 e. In other cases, marks obtained will be flat for example 20% of highest marks i.e. 0.6.

The rubric can vary depending on the tool parameters, and the value of the parameter P and Q can be considered as per the outcome of the programme.

IV. SIMULATION AND ANALYSIS OF POS

By considering the following teaching pedagogies, a PO attainment method has been created to compliance with the PO attainment and syllabus.

- Delivery through Chalk & Talk on board
- Technical Model, Paper, and Poster Presentation
- Seminars, Workshops, Conferences, and Quizzes
- Projects, Industrial Visits and Technical Trainings
- E-resources (Swayam, NPTEL, Virtual Lab, etc.)
- Notes and Assignments
- Placement Oriented Soft Skill Training
- Personality Enhancement Activities
- ICT Based Online Learning
- Social and Cultural Activities

Table: PO1 (Engineering Knowledge) Target and Attainment

Tool	Parameter	Weight-age	Mapping	Max. Marks	Marks Obtained
Academic Assessment 50%	Internal Theory Assessment	20%	H	3	3
	External Theory Assessment	5%	L	1	0.2
	Project Work	10%	M	2	2
	Lab/Experiments	10%	M	2	2
	Industrial training	5%	L	1	1
P-lacement 20%	Final Placed Strength	5%	H	3	0.6
	Mentoring/ Counselling	5%	H	3	3

	Soft skill training	4%	M	2	2
	Higher Studies	3%	L	1	0.2
	Govt. Jobs	3%	L	1	0.2
Beyond Curricul um 20%	Technical Activities	5%	H	3	3
	Conference/ Workshops	5%	H	3	2.4
	Social Events/ Extra Activity	5%	H	3	0.6
	E-Resources	3%	M	2	1.6
	Industrial visit	2%	L	1	0.2
Feedbac k 10%	Course Exit	1%	L	1	1
	Program Exit	4%	H	3	3
	Alumni	1%	L	1	0.2
	Faculty	3%	M	2	2
	Other Stakeholders	1%	L	1	0.6
Total for PO-1		**100 %**	**60**	**39**	**28.8**
Target				**65 %**	
Attainment					**48%**

The PO attainment values are calculated on the basis of the variables P = 70 and Q = 65. The value of P & Q will vary according to the input and discussion held with the stakeholders, and programme. Table-1 is a full sample of an evaluation method for PO1 (Engineering Knowledge), in which the target and achievement values are calculated.

The weight-age of tool parameters is again defined after discussion with the stakeholders and the target is calculated by considering that all tool parameters are mapped as high (H/3), and the attainment of the PO is determined on the basis of marks obtained in different direct and indirect activities by the students.

Similarly, the values for PO2 (Problem Analysis) to PO12 (Life-Long Learning) are calculated and the graphical analysis is presented in figure-2, the gaps in the curriculum are observed.
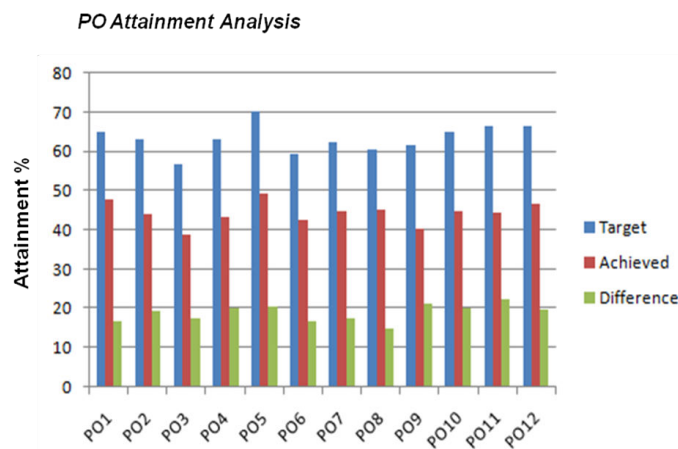

Fig. 2 Graphical analysis of PO attainment.

The gap analysis describes the areas of deficiencies, and for that the gap is determined by taking the difference between target and attainment values, from this gap analysis, the following poor areas are identified.

- Students are lagging in relating theoretical aspects with Practical
- Lack of Reasoning Aptitude
- Deficiencies in communication and soft skills
- Inability to connect social and professional aspects
- Involvement and participation in R&D work is poor

The remedial actions are implemented to fill the gap and to improve the PO attainment levels for the further assessment years by giving more emphasis on the identified weak areas through conducting more activities like Extra Assignments, Classes, Invited Talks, Re-Tests, Project Competitions, Technical training, Industry Interaction through visits, strong Mentor-Mentee system, Technical Events, Conferences, Workshops, Seminars, etc.

V. CONCLUSION

The adoption of outcome-based education is in that the targets of POs are set through a predefined mechanism. It is a solution for improving the effectiveness of the higher education system. The attainment percentage of POs is calculated based on the student's performance during a complete academic session by using the attainment tool. The gaps are identified from the predefined targets and attainment, and to fill the gap, remedial actions are taken after consulting stakeholders to improve the performance of the academic system.

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