Methodology For Course Outcomes Attainment Analysis For An Engineering Course

Pravin G. Kulkarni, Ami R. Barot

Abstract: Accreditation is a quality assurance and improvement process that determines whether the set educational objectives meet a general standard of quality. It is an endorsement of how good these expectations are satisfied. Outcome based education system (OBE) emphasizes on quantifying what the students are capable of doing. Program outcomes represent the knowledge, skills and attitudes the students should have at the end of program. Program outcomes can be directly measured through Course Outcomes which are broad statements indicating knowledge and skills the student acquires at the end of a course. The outcome based education model is based on defining various parameters called as Graduates Attributes. Assessment of learning outcomes is one of the key aspects of OBE model. This is done through assessment of course outcomes for each course in a program. In this paper, an approach based on assigning two step weights for assessment of course outcomes is presented. The method proposed provides the result of course outcome attainment. The results are obtained through a program in MS Excel.

Index Terms: Course Outcomes, Outcome based education, Program Outcomes, Weights.

1 Introduction

THE education system in India over past few years has adopted Outcome Based Education (OBE) model since the model has potential to measure the learning outcomes. Accreditation is a derivative of outcome based education. In view of employment becoming more and more challenging, attributes such as knowledge, skill, values, attitude must be given due importance. This calls for design of the whole educational process that enables graduates to meet the set goals. The students should successfully demonstrate these attributes at the end of program which comprise of many courses. Quality of teaching must be judged from quality of learning. Hence each program must have intended outcomes. For each course, course outcome statements are formed which have linking with program outcomes. There must be a systematic and documented process in place for attainment of course outcomes which further contributes to attainment of program outcomes. The various steps in outcome based education are:

- Setting the objectives and outcomes
- Defining outcome based process
- Designing outcome based curriculum
- Outcome based delivery and learning
- Assessment and evaluation of outcomes

This paper presents a methodology for Course Outcomes attainment based on assigning weights corresponding to exam heads and CO correlation with them. One of the key steps in attainment of course outcomes is setting the target value. The following section explains the methodology in detail.

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2 Framework of OBE

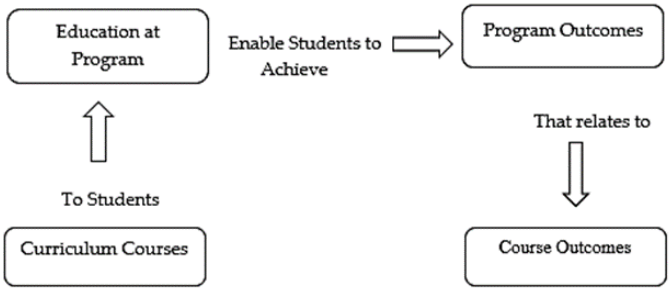

***Fig. 1** OBE framework*

Fig.1 shows framework of Outcome Based Education (OBE). OBE is an educational process which is based on making an endeavor to achieve certain specified outcomes in terms of student learning. The three components that encompass an outcome-based approach to learning are:

- An explicit statement of learning intent expressed as outcomes
- Approach to enable the intended learning to be achieved and demonstrated (curriculum, teaching, learning, assessment and support and guidance methods)
- Criteria for assessing learning aligned to the intended outcome

Course Outcomes (COs) are broad statements of what a student should be able to demonstrate upon completion of a course. COs are the measurable, achievable, realistic attributes and are based on Bloom's Taxonomy. Each course outcome must be mapped to program outcomes POs and Program Specific Outcomes (PSOs). The extent to which each CO correlates with respective PO can be expressed as low, medium or high. Collective COs for all courses in a curriculum must address all POs and PSOs.

3 METHODOLOGY

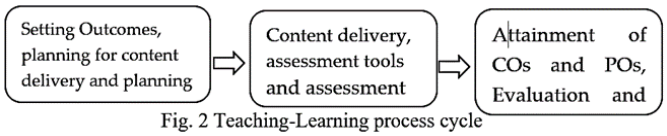

Fig. 2 Teaching-Learning process cycle

This section describes in detail the methodology adopted for the attainment of the course outcomes for an engineering course in Mechanical program. Fig. 2 shows Teaching-Learning process cycle. Firstly, the course objectives and course outcomes are set for the course. Different assessment tools are planned along with the schedule. In the next phase, course contents are delivered as per the prepared lesson plan and based on the assessment tools, assessment is carried out. In the third phase, based on the marks obtained by students, analysis and evaluation of course outcomes is done along with planning of steps for continuous improvement. As per the evaluation scheme for an engineering course, database in excel is prepared indicating student wise marks for different examination heads such as University Theory exam, Oral, Practical, Term work, internal assessment tools such as class test, assignment, laboratory practices etc. As shown in Table 1, the database shows student wise marks for each exam head along with the COs that are mapped. The tools for CO attainment are external and internal. The external assessment tools are given 70% weightage and 30 % weightage is given to internal assessment tools. Total CO attainment is calculated as:

CO Attainment = 70 % of external assessment + 30 % of internal assessment

In the next phase of CO attainment calculations, two stage weights are given. The courses can be categorized as A, B, C, D depending on the evaluation scheme such as Theory/Practical/Oral/Term work as the case may be. Weight W1 is assigned accordingly. The sample course under study has Theory, Oral and Term work and the weights are assigned as per the Table 2. The next weight W2 corresponds to each CO and its correlation with the respective evaluation head as shown in Table 3. Assigning weight W2 for each CO w.r.t each exam head calls for taking into account previous two years question paper and domain expertise of the course owner. This is critical in a sense that change in a particular weight results in altogether different value of CO attainment which in turn affects actions to be proposed. External ENDSEM total marks are diffused into CO1 to CO6 marks using following formula:

CO1=W1*W2*ENDSEMMark+W1*W2*ORAL MARK+W1*W2*TERM WORK MARK (1)

In the similar way, CO2 to CO6 marks are calculated and table 4 is prepared shown below. Once CO wise marks are prepared in a tabular from, the appropriate target is to be set for measurement of co attainment. One of the key steps in attainment of Course Outcomes is fixing appropriate Target Value which is based on performance of the students for the same course in earlier year. This can be done by taking into account average marks for last year. Based on this, the target is fixed for attaining course outcomes for the course under discussion. Finally attainment levels are to be fixed based on what population of students score above the target mark. For higher population the attainment level is marked as 3 and accordingly. The attainment levels for each exam head is tabulated in Table 5. Result of final CO attainment is plotted in Fig. 3.

4 CONCLUSIONS

The work presented in the paper proposes a method based on assigning weights best suited to the evaluation scheme of a course and their mapping with Cos. One of the key aspects in the process of CO attainment is fixing the target value. The proposed method takes into account the major population of students for setting the target. The paper basically focus on direct attainment of Course Outcomes based on which attainment of Program Outcomes can be measured.

Table 1 *Database for an Engineering Course (for Direct CO attainment)*

Course		**External Assessment**							**Internal Assessment**				
Roll No.	Name of Student	INSEM (30) UNIT 1, 2, 3 Each 10 Max Marks				ENDSEM (70) UNIT 1 to 6	TW (25) UNIT 1 to 6	OR (50) UNIT 1 to 6	Class Test (30) UNIT 1, 2, 3 Each 10 Max Marks				Assignment (30) UNIT 1 to 6
COS		CO1	CO2	CO3	TOTAL	ALL COS	ALL COS	ALL COS	CO1	CO2	CO3	TOTAL	ALL COS
1	STUDENT 1	7	9	8	24	65	23	40	8	7	7	22	24
2	STUDENT 2	8	8	9	25	60	23	36	8	8	7	23	21
3	STUDENT 3	6	8	8	22	58	20	38	6	8	7	21	25
4	STUDENT 4	9	9	7	25	66	21	42	8	7	6	21	21
5	STUDENT 5	7	7	6	20	59	22	39	6	5	7	18	27
6	STUDENT 6	9	7	7	23	62	23	39	8	7	8	23	24
7	STUDENT 7	7	6	4	17	65	22	36	7	7	6	20	26
8	STUDENT 8	3	8	4	15	59	21	40	7	5	8	20	24
9	STUDENT 9	5	9	9	23	61	20	43	7	7	5	19	22
10	STUDENT 10	1	4	9	14	65	19	41	6	5	6	17	25

Table 2 *Weight W1 as per the evaluation scheme*

Category A		
TH	OR	TW
0.5	0.3	0.2

Table 3 *Weight W2 for each CO w.r.t evaluation scheme*

Distribution of Cos based on last 2 yrs TH,OR,TW						
Engineering Course	**Course Outcomes**					
	CO1	CO2	CO3	CO4	CO5	CO6
TH	0.15	0.15	0.15	0.15	0.15	0.25
OR	0.1	0.3	0.1	0.2	0.2	0.1
TW	0.2	0.25	0.1	0.1	0.1	0.25

Table 4 *CO and marks for external tools*

CO and Actual Marks					
CO1	CO2	CO3	CO4	CO5	CO6
7.0	7.2	6.5	8.1	7.7	10.5
6.5	6.7	6.0	7.4	7.1	9.7
6.3	6.5	5.9	7.4	7.0	9.4
7.1	7.3	6.6	8.3	7.9	10.6
6.5	6.7	6.0	7.5	7.2	9.6
6.7	7.0	6.3	7.8	7.5	10.1
6.8	7.1	6.4	7.8	7.5	10.3
6.5	6.7	6.0	7.6	7.2	9.6
6.7	6.9	6.3	8.0	7.6	9.9
6.9	7.1	6.5	8.2	7.7	10.3

Table 5 *Attainment level for each exam head*

EXAM HEAD	CO1	CO2	CO3	CO4	CO5	CO6
UNIVERSITY ENDSEM EXAM	3.0	3.0	0.0	3.0	3.0	3.0
UNIVERSITY INSEM EXAM	1.00	3.00	2.00			
UNIV INSEM+ENDSEM EXAM (70%)	2.00	3.00	1.00	3.00	3.00	3.00
INTERNAL TEST	2	2	1			
INTERNAL ASSIGNMENT	3.00	3.00	3.00	3.00	3.00	3.00
INT TEST+INT ASSIGNMENT (30%)	2.50	2.50	2.00	3.00	3.00	3.00
FINAL ATTAINMENT (70%+30%)	2.15	2.85	1.30	3.00	3.00	3.00

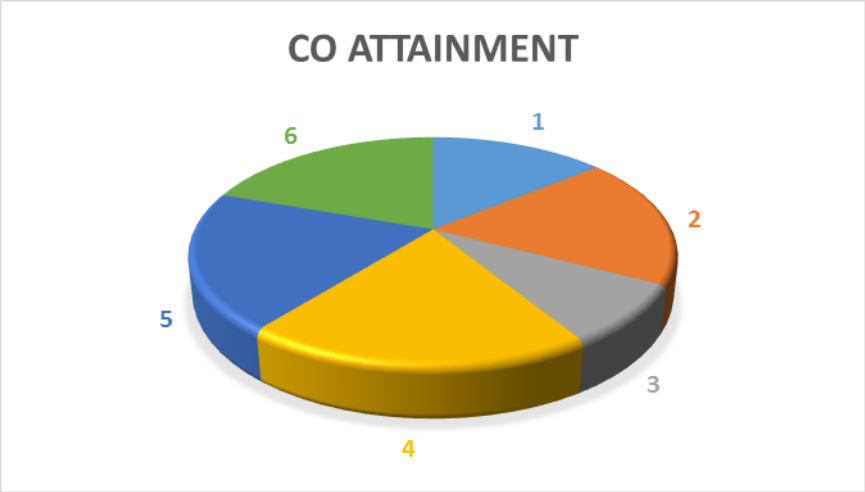

Fig. 3 *Result of final attainment*

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