COURSE LEARNING OUTCOMES ATTAINMENT IN POLYTECHNIC INSTITUTIONS OF INDIA

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Abstract -Ever since India has become the permanent signatory member of the Washington Accord since 2014, India has started implementing Outcome Based Education(OBE) in higher technical education programs such as diploma, undergraduate and postgraduate Programs. The National Board of Accreditation(NBA) has started accrediting only the programs offering Outcome Based Education(OBE) since 2017. Outcome Based Education is an education approach that focuses on the graduate attributes/Program Outcomes a pass out student should possess after completing an academic program. Outcomes are the abilities acquired by the student at the end of the program. They are nothing but what the student should be able to do at the end of the program/Course/Instructional Unit. This paper makes a sincere attempt to assess whether the Course Outcome in terms of Student Learning Outcomes(SLOs) specified in a particular course are attained or not based on results of various examinations and mapping of CO-PO and their attainment levels.

Keywords - Course Outcomes, Curriculum, Outcome Based Education, Program Outcomes, Student Learning Outcome

I. INTRODUCTION

Curriculum is the total plan for teaching -Learning process, assessment and evaluation plans for the program of study. Outcome Based Curriculum basically is targeted to achieve the Program Outcomes/Graduate Attributes(GAs). Attainment of POs indicates that the curriculum is well done.The curriculum in the present system is largely teacher centered rather than student centered, therefore fails to produce competent engineers who can apply the set of knowledge, skills and attitude that they have learnt throughout the program to solve industrial complex problems. A considerable perercentage of questions in end semester examinations today belong to the category of remembering and understanding level. This is resulting in lack of Graduate Attributes amongst the graduates. Ultimately industries do not want knowledge, they require competent work ready engineers who can provide solutions to the complex problems. The Outcome Based Education provides solutions to such type of technical education system.

Course Learning Outcome assessment.

While designing OBE, it is top to bottom approach ie., starting from of vision, mission, Program Educational Objectives(PEOs), Program Outcomes(POs), Programme Specific Outcomes(PSOs), Course Outcomes(COs) and the Student Learning Outcomes(SLOs) whereas while implementing it is bottom up approach ie., implementation starts from achievement of LOs first, and then COs, POs, PSOs, PEOs, Mission and then finally Vision. The same is depicted in the block diagram in the Fig.1.

Significance of the Research study

At the time of starting the course normally targets for that course are set in terms of Course Outcomes such as CO1,CO2and CO3.There may be more than three COS but for ease only 3 Cos are considered here. After setting such targets, course work goes on, exams are conducted, results are declared, result analysis is done and attainment values are computed to know what attainment level that CO1, CO2 and CO3 have reached. Ideally these attainment values should be ≥ COs set values. If they are equal or greater, then the set targets for CO1, CO2 and CO3 is attained. . If they are less, then it results in the form of deviation between target and attainment. Depending on the magnitude and sign of the of the deviation and some corrective action should be introduced into the curriculum which is normally called as curricular components given to students with modifications which may be in terms of arranging guest lecture, field training, more tutorials, more mentorship, show some animations etc.,.

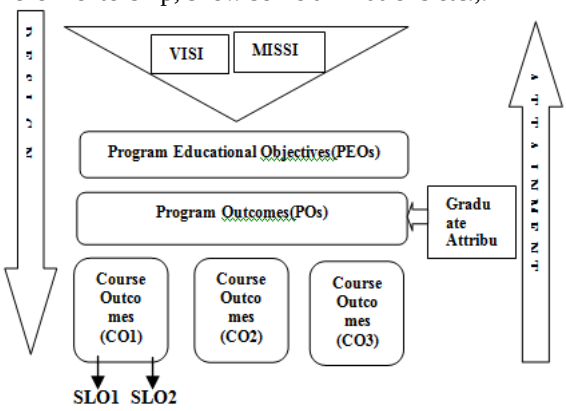


Fig.1 Outcome Based Education

This is depicted in Fig.2.This research paper mainly focus on the analysis of the results for Course attainment. Although this appears to be a cumbersome tedioustask but if a faculty develops the

habit of developing immediately after each exams tabulate this. The desire to know is far more important than achievement and/or performance measures – Caine & Caine.

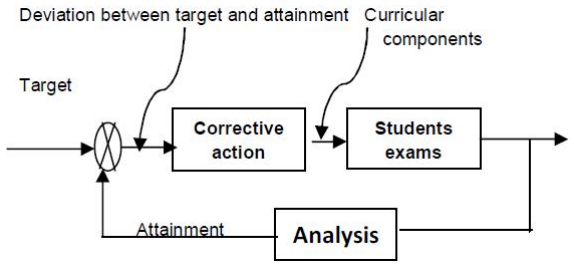


Fig.2 Course Learning Outcome assessment

According to this quote, if at the end of the course if a student gains to develop a curiosity to learn the unknown component, that may be the best performance measure. If so then why going for such complicated, tedious process? There are two reasons. First reason is going for Accreditation. In case if the Program is going for accreditation then NBA evaluation team wants in terms of number crunches not subjective. The second reason is the desire to know is subjective.

II. RESEARCH METHODOLOGY

The research methodology is outlined as below:

a. Discussion of Few terms
b. Identify data required for assessment
c. Tabulation of exam scores
d. Course assessment worksheet

a. Discussion of few terms:

SLO – Student LearningOutcome, Describes what a student is expected to learn and demonstrate ie., a set of knowledge, skills and attitude

CO - Course Outcomes are narrower statements that describe what students should be able to do at end of a course in terms of skills, knowledge, and behaviour that students acquire in their matriculation through the course.

PO - Program outcomes are narrower statements that describe what students are expected to know and be able to do immediately after graduation.

POs are defined by NBA and are as shown below:

Basic Knowledge	Environment and Sustainability
Discipline Knowledge	Ethics
Experiments and Practice	Individual and Team Work
Engineering Tools	Communication
The Engineer and Society	Life–Long Learning

b. Identify the data required for assessment

Examples of data collection processes may include, but are not limited to Specific exam/tutorial questions, assignments, laboratory tests, project evaluation, student portfolios etc.,

Data to be collected

The above data are to be collected for each mid sem test and end semester exam of each course during each academic year, obtain question papers and answer scripts. From the question paper, for each question, identify relevant CO and PO, maximum marks allotted for each question(5th row in Heading in Table.1),marks secured by each student for each question

c. Tabulation of exam score

The tabulation of the various mid semester test, assignment and end semester exam scores done as below:

M1Q1- Mid semester test Question1,M2Q2- Mid semester test Question 2 and so on

A1Q1 - Assignment 1 Question1, A2Q2 - Assignment 2 Question 2 and so on

ESQ1 -End semester Question 1, ESQ2 -End semester Question 2 and so on

Typically the end semester exam answer books are not given back, therefore all the information one has is only the total marks. If there are three COs -CO1, CO2 and CO3, it is assumed that each CO has got the same maximum allotted marks of 84. If a student scores total 42 marks in end semester exam, then assume 42 to all the COs. Marks considered in Table.1 are hypothecate marks and the data so collected needs to be systematically arranged into a Excel sheet as shown below in Table.1

d. Course assessment worksheet

Subject code	C303.2	Faculty - Dr. Ram
Subject Name	DC Machine & Transformer	*N = Present but not attmpted
Academic Year, Year, Semester	2015-16, II Year,III semester	* A – Absent for the examination

There are two methods of attainment calculation.

Attainment Method 1.

Uses percentage(The values entered in this row is obtained as below)

If the % of students who got marks ≥80% , attainment level is 3,

If the % of students who got marks between 70% and 80% , then attainment level is 2,

If the % of students who got marks between between 60% & 70%, then attainment level is 1

If the % of students who got marks < 60% - "0"

Attainment Method 2

% of students who got more than the average. The average score of the first column indicates that 56 students have got marks more than the average in M1Q1 for CO1

Table.1 Tabulation of scores of 60 students in Mid sem test1, Mid sem test2, Assignment1 and end sem exam

Sl. No.	Enrolment No.	Name of student	Mid sem Test 1					Mid sem Test 2					Assignment 1					End sem exam		
			M1Q1	M1Q2	M1Q3	M1Q4	M1Q5	M2Q1	M2Q2	M2Q3	M2Q4	M2Q5	A1Q1	A1Q2	A1Q3	A1Q4	A1Q5	ESQ1	ESQ2	ESQ3
			PO1	PO2	PO2	PO3	PO2	PO1	PO1	PO2	PO3	PO2	PO1	PO2	PO2	PO2	PO2	PO1	PO2	PO3
			CO1	CO2	CO2	CO3	CO2	CO1	CO1	CO2	CO3	CO2	CO1	CO2	CO2	CO2	CO2	CO1	CO2	CO3
			6	8	8	8	8	6	8	8	8	8	6	8	8	8	8	84	84	84
1		S1	0	N	N	8	0	0	N	0	N	0	N	N	8	N	0	N	N	N
2		S2	5	3	0	8	N	5	6	6	1	3	3	N	5	2	2	42	42	42
3		S3	3	4	N	3	5	5	5	4	N	3	1	N	5	N	7	14	14	14
4		S4	2	2	0	8	2	6	6	4	5	4	4	6	6	1	7	56	56	56
5		S5	4	8	8	7	N	4	7	4	3	N	2	8	6	7	2	28	28	28
6		S6	0	2	N	8	N	4	4	4	N	N	2	0	8	N	2	28	28	28
7		S2	2	6	N	0	N	2	6	4	N	N	2	6	8	N	2	28	28	28
8		S2	3	6	6	8	N	2	4	6	8	N	5	2	8	7	6	70	70	70
9		S2	3	2	8	0	N	5	3	4	3	N	0	1	5	1	6	0	0	0
10		S2	2	2	0	2	0	1	6	6	N	N	4	1	5	1	1	56	56	56
11		S2	3	1	N	8	N	5	N	5	N	5	6							
12		S2	0	0	7	6	6	5	N	3	N									
13		S2	3	6	7	8	N	4	N	4	5									
14		S2	5	0	N	0	N	2	N	2	2									
15		S2	6	N	N	0	N	3	N	3	6									
16		S2	0	5	0	0	N	N	6	2	0									
17		S2	2	3	N	7	6	4	3	6	7									
18		S2	1	3	1	8	N	3	6	7	3									
19		S2	5	N	5	7	0	2	4	6	N									
20		S2	N	5	N	0	6	2	4	7	2									
21		S2	2	3	0	6	5	6	N	6	6									
22		S2	4	6	5	7	5	3	N	5	6									
2		S2	2	7	5	6	N	3	6	8	7									

Sl. No.	Enrolment No.	Name of student	Mid sem Test 1					Mid sem Test 2					Assignment 1					End sem exam		
			M1Q1	M1Q2	M1Q3	M1Q4	M1Q5	M2Q1	M2Q2	M2Q3	M2Q4	M2Q5	A1Q1	A1Q2	A1Q3	A1Q4	A1Q5	ESQ1	ESQ2	ESQ3
			PO1	PO2	PO2	PO3	PO2	PO1	PO1	PO2	PO3	PO2	PO1	PO2	PO2	PO2	PO2	PO1	PO2	PO3
			CO1	CO2	CO2	CO3	CO2	CO1	CO1	CO2	CO3	CO2	CO1	CO2	CO2	CO2	CO2	CO1	CO2	CO3
			6	8	8	8	8	6	8	8	8	8	6	8	8	8	8	84	84	84
3																				
24		S2	5	7	N	5	4	3	5	4	6									
25		S2	2	7	6	8	N	6	N	6	6									
26		S2	2	N	5	6	5	5	5	7	6									
27		S2	5	6	0	6	5	6	N	4	6									
28		S2	1	2	6	3	4	5	3	2	2									
29		S2	5	8	7	8	N	4	6	7	N									
30		S2	5	5	N	6	6	5	5	5	5									
31		S2	0	6	0	7	N	5	N	3	5									
32		S2	3	0	N	5	N	4	N	N	5									
33		S2	0	N	6	8	N	4	8	3	5									
34		S2	6	5	0	8	N	5	0	4	N									
35		S2	0	4	0	8	0	4	N	3	N									
36		S2	0	4	0	5	2	5	N	3	3									
37		S2	1	6	N	5	0	N	0	4	N									
38		S2	1	0	N	2	0	6	N	4	3									
39		S2	2	2	2	8	0	5	6	5	N									
40		S2	0	4	6	6	N	5	6	7	6									
41		S2	2	5	0	0	N	5	N	5	6									
42		S2	A	A	A	A	A	A	A	A	A									
43		S2	1	4	5	8	2	5	3	5	3									
44		S2	2	2	0	7	0	5	2	6	N									
4		S2	1	6	N	5	0	0	0	0	N									

Sl. No.	Enrolment No.	Name of student	Mid sem Test 1					Mid sem Test 2					Assignment 1					End sem exam		
			M1Q1	M1Q2	M1Q3	M1Q4	M1Q5	M2Q1	M2Q2	M2Q3	M2Q4	M2Q5	A1Q1	A1Q2	A1Q3	A1Q4	A1Q5	ESQ1	ESQ2	ESQ3
			PO1	PO2	PO2	PO3	PO2	PO1	PO1	PO2	PO3	PO2	PO1	PO2	PO2	PO2	PO2	PO1	PO2	PO3
			CO1	CO2	CO2	CO3	CO2	CO1	CO1	CO2	CO3	CO2	CO1	CO2	CO2	CO2	CO2	CO1	CO2	CO3
			6	8	8	8	8	6	8	8	8	8	6	8	8	8	8	84	84	84
5																				
46		S2	2	2	3	3	N	5	4	5	3									
47		S2	0	0	6	5	N	5	0	3	N									
48		S2	1	4	1	6	0	1	N	6	7									
49		S2	1	2	N	8	0	5	3	4	4									
50		S2	2	3	7	8	N	6	7	7	7									
51		S2	2	0	N	0	0	5	0	3	3									
52		S2	1	2	0	5	N	5	5	4	6									
53		S2	0	0	N	5	N	5	2	3	2									
54		S2	1	2	N	8	0	6	7	7	7									
55		S2	1	1	N	7	N	0	3	5	3									
56		S2	3	2	N	3	N	2	N	7	4									
57		S2	0	6	N	5	0	5	2	4	2									
58		S2	1	2	N	7	0	5	N	6	3									
59		S2	0	N	N	N	N	N	3	0	N									
60		S2	A	A	A	A	A	5	N	4	5									
No. of students who attempted			57	52	34	57	29	56	39	58	43									
No. of students who got >40%			18	24	16	43	11	45	24	43	26									
% of students who got >40%			32	46	47	75	38	80	62	74	60									
Attainment method 1			0	0	0	2	0	3	1	2	1									
% of students who scored>average			56	58	53	75	48	71	62	74	60									
Attainment method2			0	0	0	2	0	2	1	2	1									

Sl. No.	Enrolment No.	Name of student	Mid sem Test 1					Mid sem Test 2					Assignment 1					End sem exam		
			M1Q1	M1Q2	M1Q3	M1Q4	M1Q5	M2Q1	M2Q2	M2Q3	M2Q4	M2Q5	A1Q1	A1Q2	A1Q3	A1Q4	A1Q5	ESQ1	ESQ2	ESQ3
			PO1	PO2	PO2	PO3	PO2	PO1	PO1	PO2	PO3	PO2	PO1	PO2	PO2	PO2	PO2	PO1	PO2	PO3
			CO1	CO2	CO2	CO3	CO2	CO1	CO1	CO2	CO3	CO2	CO1	CO2	CO2	CO2	CO2	CO1	CO2	CO3
			6	8	8	8	8	6	8	8	8	8	6	8	8	8	8	84	84	84
Net attainment			0	0	0	2	0	2	1	2	1									

Note: Marks considered in Table.1 are hypothecate marks

Table.2 CO-PO attainment through various tools

Course Outcomes On successful completion of this course the students will be able to		Tools used for evaluation	PO1	PO2	PO3
CO1	Apply knowledge of basic mathematics, sciences and basic engineering to solve the broad electrical engineering problems(PO1)	M1Q1	0		
		M2Q1	3		
		A1Q1	1		
		ESQ1	1		
CO2	Apply discipline - specific knowledge to solve core and/or applied problems. (PO2)	M1Q2		0	
		M1Q3		0	
		M1Q5		0	
		M2Q2		1	
		M2Q3		2	
		A1Q2		0	
		A1Q3		2	
		A1Q4		0	
		A1Q5		2	
		ESQ2		1	
CO3	Plan to perform experiments and practices and to use the results to solve problems.	M1Q4			2
		M2Q4			1
		M2Q5			0
		Average Score	1.25	0.8	1
		Outcome satisfied	**NO**	**NO**	**NO**

Minimum Set level for PO attainment : 2

Table.3 CO-PO attainment

CO1	PO1	1.25	Apply knowledge of basic mathematics, sciences and basic engineering to solve the broad electrical engineering problems
CO2	PO2	0.8	Apply discipline - specific knowledge to solve core and/or applied problems.
CO3	PO3	1	Plan to perform experiments and practices and to use the results to solve problems.

RESULTS

The CO-PO attainment of the subject DC Machines & Transformer in diploma program of Electrical engineering is as shown in the Table. 3 and Table.4, where the set target level of PO attainment was 2. But it is found from the course assessment sheet that CO1 –PO1 mapping is only 1.25 similarly CO2-PO2 is 0.8 and CO3-PO3 is 1and all below the set target of 2. The recommendations for curricular components would be advantageous if some topics are practically demonstrated and the questions are properly framed, organizing some group activity, showing some animations, arranging expert lectures, industrial visits etc., so that the actual learning takes place amongst the students.

CONCLUSION

This paper makes a sincere attempt to assess whether the Course Outcome in terms of Student Learning Outcomes(SLOs) specified in a particular course are

attained or not based on mid semester tests, assignments and end semester examinations and computations need to be done for mapping of CO-PO and its attainment level which will enable the individual faculty to know about the attainment of CO and PO in his/her Course which in turn provide a feedback about students learning.

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