

Attainment of Programme Outcomes Through Course Outcomes In Outcome Based Education: A Case Study

Balasubramani R¹, Niranjan N Chiplunkar²

¹Dept. of ISE Professor, ² Dept. of CSE & Principal

^{1,2}NMAM Institute of Technology, Nitte

¹balasubramani.r@nitte.edu.in, ²nchiplunkar@nitte.edu.in

Abstract: In the new Outcome Based Education model as prescribed by National Board of Accreditation (NBA), one of the most important criteria is the Attainment of Programme Outcomes (POs). The Programme Outcomes are specific rather than narrower statements that describe what students are expected to know and be able to do upon the graduation. These relate to the skills, knowledge, and behavior that students acquire in their matriculation through the programme. The Programme Outcomes can be attained through the attainment of Course Outcomes of the courses pertaining to that programme. In this paper a sample course viz. Building Enterprise Applications has been selected to demonstrate the process involved in the attainment of Course Outcomes. The contribution of Course Outcomes to Programme Outcomes is also demonstrated.

Keywords: Outcome Based Education, Course Outcomes, Programme Outcomes

1. Introduction :

To bring in Quality in Technical Institutions, the Govt. of India is in the process of making Accreditation mandatory. In India, National Board of Accreditation (NBA) is the body responsible for accrediting the Technical Programmes [1]. As India has become the permanent member of Washington Accord since 13 June 2014, Technical Institutions need to follow Outcome Based Education (OBE). In OBE, one of the main criteria is the attainment of Programme Outcomes (POs). The POs formulated for each programme by the institute must be consistent with the NBA's Graduate Attributes such as: a) Engineering Knowledge, b) Problem Analysis, c) Design / Development of Solutions, d) Conduct Investigations of Complex Problems, e) Modern Tool Usage, f) The Engineer and Society, g) Environment and Sustainability, h) Ethics, i) Individual and Team Work, j) Communication, k) Project Management and l) Life-Long Learning. These POs can be attained through Course Outcomes (COs).

The process involved in the attainment of Course Outcomes and how the attainment of COs lead to attainment of POs is demonstrated in next section.

2. Assessment Tools

To begin with various Direct and Indirect Assessment Tools that contribute to the COs attainment need to be clearly specified [4]. The Direct Tools can be Task 1 and Task 2 Performance, Mid

Dr. Balasubramani R

Dept. of ISE Professor,

NMAM Institute of Technology, Nitte

balasubramani.r@nitte.edu.in

Semester Examination 1 and Mid Semester Examination 2 Performance, Semester End Examination Performance. The Indirect Tools can be Course Exit Survey [2]. Attainment Levels can range from 1 to 5. The tables below summarize the tools, attainment levels and their weightage in assessment [6]

Table 1: Assessment Tools

Abbreviation	Name	Type
TK	Task	Direct
MSE	Mid Semester Examination	Direct
SEE	Semester End Examination	Direct
CES	Course Exit Survey	Indirect

Table 2.a: Attainment Levels

Attainment Level	TK, MSE, SEE
1	40-49% of students score $\geq 60\%$
2	50-59% of students score $\geq 60\%$
3	60-69% of students score $\geq 60\%$
4	70-79% of students score $\geq 60\%$
5	80% and above students score $\geq 60\%$

Table 2.b: Attainment Levels

Attainment Level	CES
1	40-49% of students marked ≥ 3
2	50-59% of students marked ≥ 3
3	60-69% of students marked ≥ 3
4	70-79% of students marked ≥ 3
5	80% and above students marked ≥ 3

Table 3: Weightage

Weightage	TK	MSE	SEE	CES
CO1	10%	20%	60%	10%
CO2	-	20%	70%	10%
CO3	10%	20%	60%	10%
CO4	-	20%	70%	10%
CO5	-	-	90%	10%

2. Building Enterprises Applications- A Sample Course

A. Defining Course Outcomes

A sample course viz., Building Enterprise Applications has been considered, which is being offered in the eight semester CS and IS streams. The

Course Code is IS801. The Course Outcomes will be denoted as C801.1, C801.2, C801.3, C801.4 and C801.5. We have considered class strength of 40. The following Course Outcomes have been defined along with the attainment planned [7].

Table 4: Course Outcomes for Business Intelligence

Sl. No.	Course Outcomes	Attainment Planned
C801.1	Have skills required to build an Enterprise Application	60%
C801.2	Create a Business Modeling of an Enterprise Application	70%
C801.3	Design an Enterprise Architecture by incorporating various hardware and networking requirements	60%
C801.4	Construct the Technical Solution Layers	70%
C801.5	Roll out an Enterprise Application after subjecting it to different types of testing	60%

B. Defining the Scheme of Evaluation

Below we have given the Scheme of Evaluation. CIE stands for Continuous Internal Examination [8].

Table 5: Scheme of Evaluation

CIE Scheme:

Assessment Name	Assessment Method	Maximum Marks
Task 1	Assignments, Quiz, Role Play etc.	5
Task 2	Assignments, Quiz, Role Play etc.	5
Mid Semester Examination 1 (MSE 1)	Test	20
Mid Semester Examination 2 (MSE 2)	Test	20
Total		50

SEE Scheme:

Assessment Name	Assessment Method	Maximum Marks	Weightage in Marks
Semester End Examination (SEE)	Test	100	50
Total			50

C. Tasks and MSE Performance Analysis

We have given Assignments for both Task 1 and Task 2 in our sample course [9]. Usually Task 1 covers the first Course Outcome. Below table shows the Task 1 Performance Analysis.

Table 6: Task 1 Performance Analysis

C801.1	Total No. of Students attended	40
	No. of Students scored $\geq 60\%$	31
	% of Students scored $\geq 60\%$	78%
	Attainment Level	4

In Mid Semester Examination 1, there will be four questions two each from first two units [10]. Students need to answer one question from each unit. Each question carries 10 marks. MSE 1 covers first two Course Outcomes. Below table shows the MSE 1 Performance Analysis.

Table 7: MSE I Performance Analysis

Details	Question 1 / Question 2 (C801.1)	Question 3 / Question 4 (C801.2)
Total no. of Students attended	40	40
No. of Students scored $\geq 60\%$	35	36
% of Students scored $\geq 60\%$	87.50%	90.00%
Attainment Level	4	5

Similarly below tables shows the Task 2 Performance Analysis. Task 2 covers third course outcome.

Table 8: Task 2 Performance Analysis

C801.3	Total No. of Students attended	40
	No. of Students scored $\geq 60\%$	27
	% of Students scored $\geq 60\%$	68%
	Attainment Level	3

The below table shows the MSE II Performance Analysis. MSE II covers third and fourth course outcomes.

Table 9: MSE II Performance Analysis

Details	Question 1 / Question 2 (C801.3)	Question 3 / Question 4 (C801.4)
Total no. of Students attended	40	40
No. of Students scored $\geq 60\%$	34	31
% of Students scored $\geq 60\%$	85%	77.5%
Attainment Level	5	4

D. SEE Performance Analysis

SEE will have 10 questions, two questions from each unit [11]. There are five units. Students need to answer one question from each unit. Each question carries 20 marks. SEE covers all the five course outcomes. Below table shows the SEE Performance Analysis.

Table 10: SEE Performance Analysis

Q. No.	CO Mapped	No. of students Attended	No. of students scored $\geq 60\%$	% of students scored $\geq 60\%$	Att. Level
1	C801.1	40	36	90%	5
2					
3	C801.2	40	35	87.5%	5
4					
5	C801.3	40	30	75%	4
6					
7	C801.4	40	35	87.5%	5
8					
9	C801.5	40	27	67.5%	3
10					

E. Course Exit Survey Analysis

Finally, the Course Exit Survey will be analyzed [12]. The survey form contains all the course outcomes and the students will rate their level of attainment as 5-Excellent, 4-Good, 3-Average, 2-Below Average and 1-Poor. The below table shows the Course Exit Survey Analysis.

Table 11: Course Exit Survey Analysis

COs	C801.1	C801.2	C801.3	C801.4	C801.5
Option 1	3	10	7	0	5
Option 2	4	9	8	9	5
Option 3	5	8	0	0	2
Option 4	3	3	5	3	5
Option 5	25	10	20	28	20
Total no. of students given CES	40	40	40	40	37
No. of students opted 3 and high	33	21	25	31	27
% of students opted 3 and high	82.50%	52.50%	62.50%	77.50%	72.97%
Attainment Level	5	2	3	4	4

F. Attainment of Course Outcomes

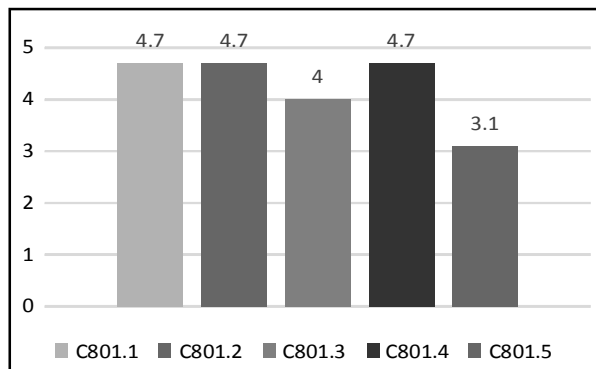
Now, taking all the inputs, we need to calculate the attainment of Course Outcomes. The below table shows the attainment of Course Outcomes [13].

Table 12: Attainment of Course Outcomes

Attainment Level	TK	MSE	SEE	CES
C801.1	4	4	5	5
C801.2	0	5	5	2
C801.3	3	5	4	3
C801.4	0	4	5	4
C801.5	0	0	3	4

Table 13: Weighted Attainment of Course Outcomes

Actual Attainment Level by giving weightage	TK	MSE	SEE	CES	Total
C801.1	0.4	0.8	3	0.5	4.7
C801.2	0	1	3.5	0.2	4.7
C801.3	0.3	1	2.4	0.3	4
C801.4	0	0.8	3.5	0.4	4.7
C801.5	0	0	2.7	0.4	3.1

Chart 1: COs Attainment for IS801**COs Attainment for IS801****Mapping of Course Outcomes To Programme Outcomes**

Next these Course Outcomes should be mapped to the Programme Outcomes at three Levels (Low, Medium and High) [14]. If the mapping is between 31-50%, then it is Low (L), if it is between 51-70%, then it is Medium (M), and if it is above 71%, then it is High (H) [15]. The below table describes them:

Table 14: COs to POs Mapping

CO -> PO	C801.1	C801.2	C801.3	C801.4	C801.5
PO a		M	H		
PO b	L		M	H	H
PO c		M	M		H
PO d			H	L	
PO e	L	M		H	

PO f		L		M	H
PO g			H	M	
PO h	M		H		
PO i		H		M	M
PO j	M		H		
PO k		H		H	
PO l	H		H		H

For the calculation purpose, we have fixed Low as 40%, Medium as 70% and High as 100%. Based on this, the attainment level is shown in below table:

Table 15: Weighted POs attainment levels

COs	Att. Level	L (40%)	M (70%)	H (100%)
C801.1	4.7	1.88	3.29	4.7
C801.2	4.7	1.88	3.29	4.7
C801.3	4	1.6	2.8	4
C801.4	4.7	1.88	3.29	4.7
C801.5	3.1	1.24	2.17	3.1

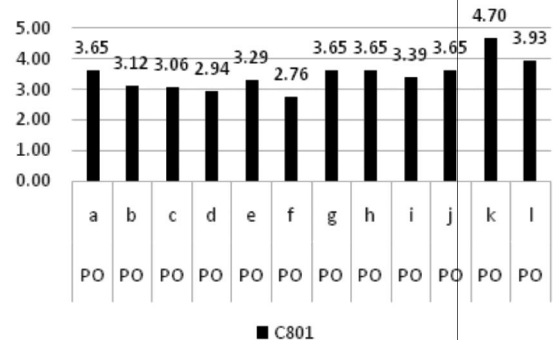
3. Attainment Of Programme Outcomes

Now we will see the POs attainment through these COs.

Table 16: Actual POs attainment through COs attainment

CO -> PO	C801.1	C801.2	C801.3	C801.4	C801.5
PO a		3.29	4		
PO b	1.88		2.8	4.7	3.1
PO c		3.29	2.8		3.1
PO d			4	1.88	
PO e	1.88	3.29		4.7	
PO f		1.88		3.29	3.1
PO g			4	3.29	
PO h	3.29		4		
PO i		4.7		3.29	2.17
PO j	3.29		4		
PO k		4.7		4.7	
PO l	4.7		4		3.1

Below table shows the Contribution of IS801 course to POs.

Chart 2: POs Attainment for IS801**CO -> PO Attainment for IS801**

4. Conclusion

In this paper, a sample course for analyzing the attainment of Programme Outcomes through Course Outcomes has been considered. Similarly, the calculations need to be done for all the courses. POs contribution of all the courses should be added together and should obtain the average. The obtained result will be the Programme Outcome of that programme. [16].

6. References

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