

Curriculum Delivery, Learning and Evaluation by Average Course Outcome Attainment & Program Outcome Attainment Method

Vinay B. Choudhari¹, Nilesh C. Gaikwad², Akshay M. Kulkarni³, Swapnil D. Gaikwad⁴, Swapnil H. Patil⁵
Department of Mechanical Engineering, Rajarambapu Institute of Technology, Rajaramnagar, Diploma, Maharashtra

Abstract:

Technical education in the country is undergoing a paradigm shift as India became a signatory member of the Washington Accord in the year 2014. Therefore, the focus of the technical education system in the country is now on outcome-based education to ensure quality and excellence. In this changed scenario, the proficiencies and abilities expected of technical teachers need to be transformed to match the changed need of the stakeholders. This is even more relevant as teachers joining the technical education system will be serving the system for the next thirty to forty years and hence implementation OBE framework is of utmost importance for their preparedness to become effective change agents. The performance of the students in the examinations during the semester in each course is used to compute the level of attainment of the POs and PSOs through the mapping of questions to COs and COs to POs and PSOs. This paper represents the process to be adopted for the calculation, of course outcome attainment & program outcome attainment by an average method.

Key words: Outcome Based Education (OBE), Course Outcome, Program Outcome, Attainment.

I. INTRODUCTION

The National Board of Accreditation (NBA), apex body for monitoring quality of engineering education in India has made it mandatory as a part of accreditation. The positive results of implementing OBE in engineering education are inevitable [5]. All polytechnics in Maharashtra state are affiliated to Maharashtra State Board of Technical Education (MSBTE), Mumbai. The curriculum given by MSBTE is revised after every five years taking feedback from all the stakeholders like Industry, Institutes, Course experts etc. The Program Curriculum is as per the scheme and syllabus approved by MSBTE, Mumbai. Curriculum maintains the balance in the composition of basic science, humanities, professional courses and their distribution in core, elective and breadth offerings. New curriculum released by Maharashtra State Board of Technical Education, Mumbai for all Polytechnics in I-scheme makes it mandatory to implement Outcome Based Education (OBE). Our present teaching learning processes are geared

towards old Input-based model rather than new Outcome-based model. There is urgent need of changing instructional methods for effective delivery of OBE. Accreditation of Engineering Institutes is a symbol excellence and has becoming mandatory. The Accreditation will help Institutes to achieve higher goals through various state and national level schemes helping in improving the quality of students & faculties. The emphasis is going to facilitate the course teacher to realize this change and open the thinking process to understand the avenues available for this purpose. These COs are mapped to POs and attainment of each PO is calculated by using copious tools considering set target levels. [4]

II. SELECTION OF ATTAINMENT METHOD

- There are two methods for calculating attainments, Threshold value and Average value.
- In the Threshold value method, no. of students scoring equal to or more than the threshold value is counted. In this method, students who are just scoring equal to the threshold value and scoring out of marks are count equal in attainment. Also, Students who are slightly missed threshold value are not counted but who are just equal to threshold value are counted, but there is a very small difference between them.
- On the other hand, in the Average method of attainment, all attempts are counted, and their contribution is considered as per their actual performance score.
- Considering, the pros and cons of the average and threshold method of attainment, we selected the average method for attainment calculation.
- The CO attainment target is set in percentage and achievement is also calculated in percentage by the average method of attainment.

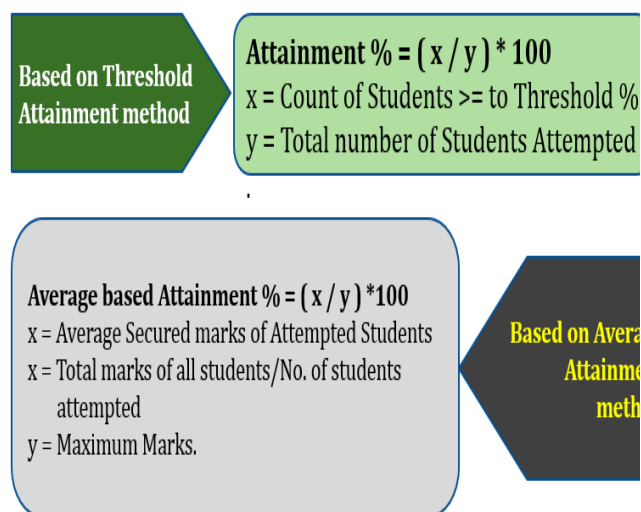


Figure 1 Comparison between Threshold & Average Method

III. COURSE OUTCOME ATTAINMENT METHODOLOGY

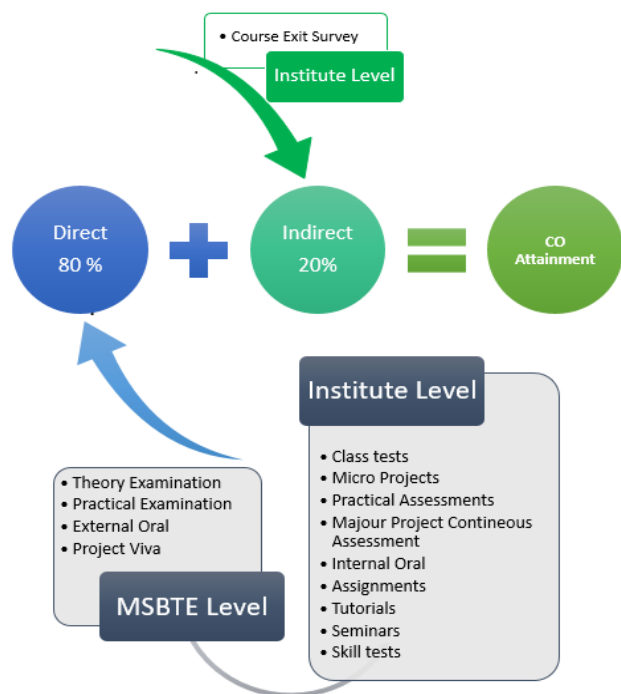


Figure 2 Course Attainment Methodology

\For calculation of course outcome, 80% weightage is given to direct assessment of course outcome as per the actual performance of students, while 20% weightage is given to the indirect assessment of course outcome through a course exit survey. The methodology of the same is shown in figure 2. Assessment focuses on quality assurance by measuring student learning outcomes in the academic programme. Assessment can be formative or summative and is typically tackled at the classroom level, the programme level, or the institutional level[8]

A. Direct Attainment Tools

- Class tests- MSBTE declares the schedule of class tests before the beginning of the academic year. As per this schedule, we conduct Class tests for assessment of course outcomes at the institute level. As per MSBTE guideline, some courses are assessed by using descriptive type of questions and some objective type pattern.
- Practical Progressive Assessments- This used to assess the practical knowledge of students. For some courses, MSBTE provides lab manuals. As per the MSBTE guideline, students are assessed during the progressive assessment of practical for course outcomes assessment.
- Internal PR-ESE- At the end of the semester practical knowledge of students is assessed by conducting the practical test. This tool is obligatory if mentioned in the MSBTE curriculum and this tool is used as per the requirement of course in charge.
- Assignments- Assignments are assessed for course outcome calculations as per the need are requirement of course in-charge.
- Tutorials- Tutorials are assessed for course outcome calculations as per the need are requirement of course in-charge.
- Seminars- Seminars are assessed for course outcome calculations as pre need are requirement of course in-charge.
- Skill tests- Skill tests are assessed for course outcome calculations as per the need are requirement of course in-charge.

Evaluation of course outcome is done with tools specified below and the assessment process is followed as per affiliating board Maharashtra State Board of Technical Education (MSBTE) guidelines

i. CO Direct Assessment Methods & Tools

Direct evaluation of course outcome is made at the Institute level and MSBTE level. SAR given by NBA suggests using 60% fixed weightage to Board level evaluation and 40% fixed weightage to Institute level evaluation with the example for calculating direct assessment of course outcome.

After classifying courses in different categories mentioned below, we calculated the weightage percentage given by MSBTE and found quite a better contribution to board evaluation in most of the courses. Hence, we selected the weightage of each assessment tool as per the MSBTE evaluation scheme. This will also help us to maintain the same record for MSBTE and NBA. For evaluation, four categories of Courses defined and evaluation tools utilized are as mentioned in table 1.

a. Theory and Practical Course Evaluation

TABLE 1 Theory and Practical Course Evaluation

Assessment Methods	Assessment Tools	Assessment Conducted by	Weightage As per I Scheme of MSBTE
	Class Test	Institute	20

Direct Assessment Method (80 % weightage)	Micro Project	Institute	10
	Practical Progressive Assessment	Institute	25
	Total	Institute	55 (36.66%)
	Theory Exam	MSBTE	70
	Practical Performance Exam	MSBTE	25
	Total	MSBTE	95 (63.33%)

b. Theory Course Evaluation

Table 2 represents the different assessment tools used for direct attainment for theory, weightage given etc.

TABLE 2 Theory Course Evaluation

Assessment Methods	Assessment Tools	Assessment Conducted by	Weightage As per I Scheme of MSBTE
Direct Assessment Method (80 % weightage)	Class Test	Institute	20
	Micro Project	Institute	10
	Total	Institute	30 (30%)
	Theory Exam	MSBTE	70
	Total	MSBTE	70 (70%)

c. Practical Course Evaluation

Table 3 represents the different assessment tools used for direct attainment of practical's weightage given etc.

TABLE 3 Practical Course Evaluation

Assessment Methods	Assessment Tools	Assessment Conducted by	Weightage As per I Scheme of MSBTE
Direct Assessment Method (80 % weightage)	Micro Project	Institute	10
	Practical Progressive Assessment	Institute	25
	Total	Institute	35 (58.33%)
	Practical performance Exam	MSBTE	25
	Total	MSBTE	25 (41.66%)

d. Capstone Project Course Evaluation

There is only one course in three years of diploma engineering which is dedicated to capstone project work. This course is involved in the final year of the course. For capstone project evaluation table 3 represents various tools used.

TABLE 4 Major Project Course Evaluation

Assessment Methods	Assessment Tools	Assessment Conducted by	Weightage As per I Scheme of MSBTE
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Direct Assessment Method (80 % weightage)	Major Project continuous evaluation	Institute	50
	Total	Institute	50 (50%)
	Project Oral Exam	MSBTE	50
	Total	MSBTE	50 (50%)

This is one of the courses which slightly crosses the limit of 60% weightage to external assessment i.e. MSBTE level assessment.

ii.CO Indirect Assessment Methods & Tools

TABLE 5 CO Indirect Assessment Methods & Tools

Assessment Methods	Assessment Tools	Assessment Conducted by	Weightage
Indirect Assessment Method (20 %)	Course Exit survey	Institute	5 X no. of COs
	Total	Institute	5 (100%)

80 % direct attainment is calculated through students' performance based on the certain assessment & evaluation tools provided by MSBTE curriculum while 20 % indirect attainment is calculated through course exit survey by giving questionnaires' related to course outcome statements to students through Moodle on 5-point scale and it will have converted into 20%. This course exit survey is taken by course teacher on the completion of a course in a semester. Sample indirect question surveys for course fluid mechanics & machinery are listed below. M-Mechanical Program, 22445-Course Code, a- CO number

- M22445a- Can you able to use Manometers & Bourdens gauge to measure pressure?
 - M22445b- Are you able to use flow meters to measure the rate of flow?
 - M22445c- Can you able to maintain flow through pipes.?
 - M22445d- Can you able to maintain the jet impact on various types of vanes for optimum efficiency?
 - M22445e- Can you able to maintain hydraulic turbines?
 - M22445f- Can you able to maintain hydraulic pumps?
- This survey is compulsory to all students where they have respond through Moodle platform.

IV. CO ATTAINMENT TARGET SETTING METHODOLOGY

The CO attainment target is set in percentage and achievement is also calculated in percentage by the average method of attainment. The flow chart represents

the target setting methodology is shown in figure 3.

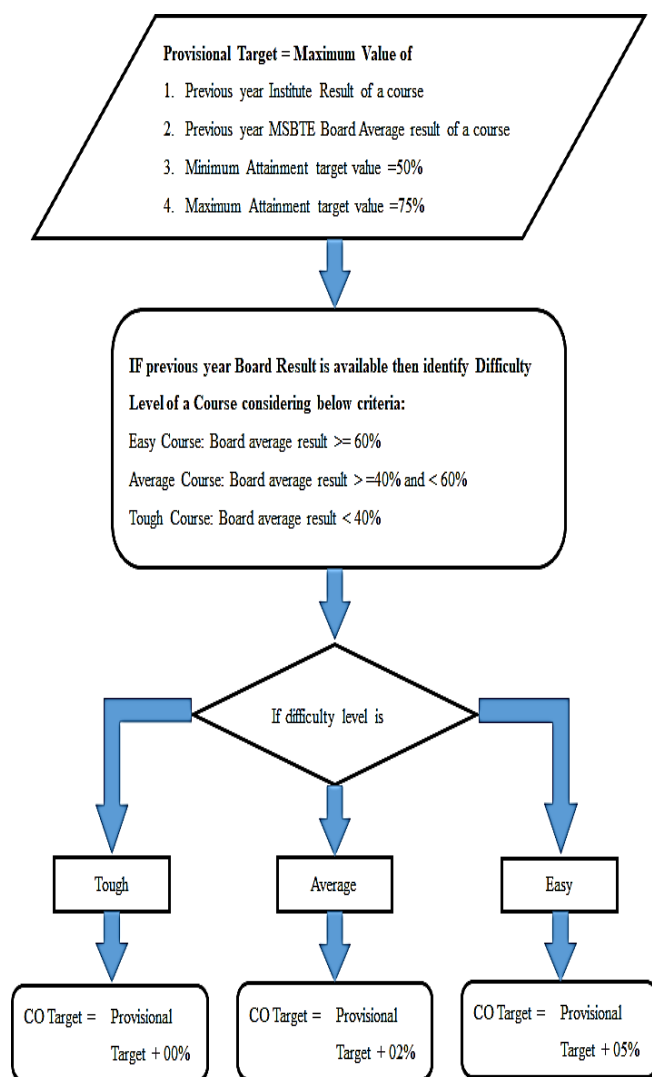


Figure 3 Flow chart of target setting methodology

- In some courses, attainment targets can deviate from value defined by the above method by giving a suitable justification.
- If Attainment achieved or CO Target becomes 100% then take the review of tools and methods and revise CO statement, assessment tools, assessment method or course curriculum delivery and define the new target.
- The CO attainment target is set in percentage and achievement also calculated in percentage by the average method of attainment.
- If targets are not achieved the program should put in place an action plan to attain the target in subsequent years
- To know the level of attainment to the course teacher, Program shall set Course Outcome attainment levels for all courses as stated below:

TABLE 6 Attainment Level

% CO Attainment	Level
From 0 up to 20	Level 1

Above 20 up to 40	Level 2
Above 40 up to 60	Level 3
Above 60 up to 80	Level 4
Above 80 up to 100	Level 5

- However, the minimum target level of achievement must be 3 and above and as per the percentage CO attainment target level. Level 1 and 2 are defined to know the level of unattained courses.

V. PROGRAM OUTCOME AND PROGRAM SPECIFIC OUTCOME ATTAINMENT METHODOLOGY

PO and PSO Assessment are done in direct and indirect ways. The contribution of Direct PO and PSO Assessment tools is 70 % and Indirect PO and PSO Assessment tools are 30 %. Depicted in figure 4.

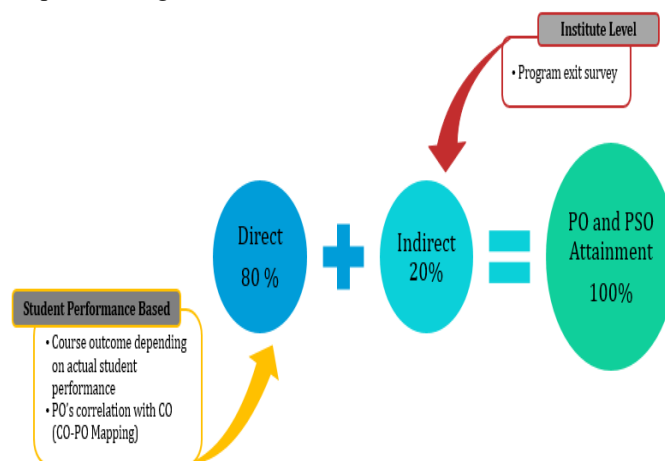


Figure 4 PO & PSO Attainment Methodology

- PO and PSO Direct Assessment Methods & Tools (70%)
 - To keep the effect of mapping and CO attainment, Multiply CO-PO Mapping by the respective CO's direct attainment percentage.
 - After multiplication, take the average of CO-wise PO / PSO attainment which gives average PO / PSO attainment out of the maximum possible value of attainment or mapping i. e. 3.
 - This PO / PSO attainment is then converted into a percentage so that attainment can be compared with the target value given in percentage. The direct attainment level of a PO and PSO is calculated by taking the average attainment of all across addressed by that PO and PSO. Then this direct attainment converted into 70%.

- PO and PSO Indirect Assessment Methods & Tools (30%)

In PO and PSO Indirect Assessment Methods, four surveys are conducted whenever available for the same students graduating from the same batch.

FOR the cycle of 2014-2017 and 2015-2018

TABLE 7 PO and PSO Indirect Assessment Methods & Tools

Assessment Methods	Assessment Tools	Assessment Conducted by	Weightage %
Indirect Assessment Method (30 %)	Program Exit survey	Institute	40
	Alumni Survey	Institute	20
	Employer Survey	Institute	20
	Higher Study Survey	Institute	20
	Total	Institute	100% (Indirect Attainment) (30% Weightage in PO & PSO as Indirect)

- On completion of the program curriculum at the end of the final semester, the program exit survey is conducted through a questionnaire on the five-point scale.
- The alumni survey is taken from the students in the next year of graduation.
- The employer and higher study survey are taken after sufficient time of observation by the concerned authority.
- This survey analysis was taken for the indirect attainment calculation of PO and PSO.
- The number of surveys is more, hence sufficient weightage of 30% is given to PO /PSO indirect attainment.
- The actual weightage of the survey in indirect attainment can be decided by the program. If its total is not 30 then it is converted into 30 so that it can be directly added to direct attainment to get overall attainment of PO / PSO.

The sample of indirect attainment calculation is as shown below in table 8

TABLE 8 Sample Indirect Attainment

20 %		40 %		Weightage	
Alumni	Program Exit	Program Exit	PO	PO 1	PO 2
5	4.43	5	5	5	5
5	4.43	5	5	5	5
5	4.29	5	5	5	5
5	4.43	5	5	5	5
5	4.54	5	5	5	5
5	4.43	5	5	5	5
5	4.46	5	5	5	5
5	4.34	5	5	5	5
5	4.6	5	5	5	5
5	4.43	5	5	5	5
5	4.85	5	5	5	5
5	4.8	5	5	5	5
5	4.78	5	5	5	5

Indirect	PO Indirect	100 %		20 %		20 %		20 %		20 %	
		PO Indirect	Higher Study	Higher Study	Employer	Employer	Employer	Employer	Employer	Employer	Alumni
27.32	100	4.6	5	4.58	5	4.73	5	4.58	5	4.58	4.27
26.38	100	4	5	4.58	5	4.54	5	4.58	5	4.58	4.27
21.67	100	4.9	5	4.58	5	4.58	5	4.58	5	4.58	4.27
26.87	100	4.3	5	4.58	5	4.65	5	4.58	5	4.65	4.27
22.24	100	4.8	5	4.58	5	4.65	5	4.58	5	4.65	4.27
21.85	100	4.7	5	4.58	5	4.65	5	4.58	5	4.65	4.27
27.84	100	4.8	5	4.86	5	4.62	5	4.86	5	4.62	4.27
27.22	100	4.6	5	4.86	5	4.54	5	4.86	5	4.54	4.27
27.66	100	4.7	5	4.58	5	4.57	5	4.58	5	4.57	4.27
27.50	100	4.8	5	4.72	5	4.54	5	4.72	5	4.54	4.27
22.90	100	4.8	5	4.58	5	4.58	5	4.58	5	4.58	4.27
22.54	100	4.6	5	4.58	5	4.58	5	4.58	5	4.58	4.27
21.76	100	4.3	5	4.58	5	4.58	5	4.58	5	4.58	4.27

VI. CONCLUSION & DISCUSSION

One of the important and arthful task in outcome based education is student's performance asseesment. It is the ceaseless process which hold root of attainment. Course attinmnet plays very vital role towards atinment of PO & PSO. All PO & PSO are contributing for the achievemnt of dpeartmental vision & mission, & which will directly aims towards the institute vision & mission. Here best suitable model i.e. average attainment method used considering all boundaries and avaalbitiy of students data , average attainment is best suited for institutes workig under the agis of MSBTE as it is very difficult to get beat wise marks scored by student in therory end semester examination which is one of the major contributor in course attinmnet. Average attainment method considers all students in a class for calculating attainment. Also here effective way of target setting methodology was implememnted which will pushes course teacher to work skillfully to achive stated targets for successive years. By adopting average attainemnt methodology Mechanical Engineering program succesfully defended NBA commite and has been accredited for 3 years.

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