Course Outcome: A Novel Model for Framing, Mapping, Assessment and Evaluation

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Abstract

National and International Accreditation processes have posed significant challenges to conventional teaching-learning practices in higher education. As per the Washington Accord, it has become mandatory to focus on **Graduate Attributes (GA)** while framing Programme Educational Objectives (PEO) and Programme Outcomes (PO), along with mapping, assessing, and attaining their outcomes.[1] This paper presents various effective modes, tools, and techniques for assessing and evaluating Course Outcomes (CO). The attributes of COs and guidelines for their framing are also discussed. An innovative yet simple model for the entire process, from framing to evaluation, is presented to maximize the overall attainment of PEOs and POs.

Keywords: Graduate attributes (GA), Programme Educational Objectives (PEO), Programme Outcome (PO), Outcome-Based Education (OBE).[2]

I. Introduction

Higher education institutions are increasingly required to comply with government and international mandates to achieve accreditation. To demonstrate the value added by higher education, institutions are implementing learning assessments and surveys focused on student learning and performance. To enhance the quality of the teaching-learning process, it is vital to set objectives and outcomes for a course delivery and to effectively assess and evaluate them.

Members of the Washington Accord follow an **Outcome-Based Model (OBM)** for degree-level institute accreditation. OBM focuses on the objectives and outcomes of the program and requires concrete evidence of their measurement and attainment [1]. According to this accord, it is mandatory to focus on all Graduate Attributes (GA) when framing Programme Outcomes (PO).[3]

GAs, as prescribed by bodies like the NBA, are based on four dimensions: **Knowledge, Skills, Behavior, Values, and Attitudes**. Since POs must satisfy all these four dimensional GAs, the

attainment level can be enhanced if these dimensions are considered early in the course objective framing process, rather than treating co-curricular or extra-curricular activities as separate elements only for skills and behavior attainment. Furthermore, NBA training material suggests that course objectives should be based on **Bloom's Taxonomy**, which is three-dimensional, enforcing the involvement of the student's *head*, *heart*, and *hand* [2].[4]

If the three dimensions of Bloom's Taxonomy or the four dimensions of Graduate Attributes are focused upon while framing the course objectives and outcomes, the entire process of framing, mapping, selecting assessment tools, evaluation, and finding attainment becomes significantly simpler. This approach also helps in the enrichment of the overall attainment level of the teaching-learning process, PEO, and PO. A novel model to achieve this is presented in this paper.

II. Attributes of Course Outcomes

Course outcomes are narrower statements that explain what students are expected to be aware of and be able to do after completing each course [1]. The following attributes of COs must be considered:

1. **Student-focused:** COs must aim at learning, not on coverage-oriented, teacher-focused delivery.[5]

2. **Alignment:** COs must reflect the objectives and outcomes of the academic program and the broader mission of the institution.[6]
3. **Focus on abilities:** COs should prepare students for the abilities central to the discipline.
4. **Enduring Learning:** They must focus on aspects of learning that will endure beyond the teaching period.
5. **Manageable Number:** COs should be limited (e.g., 4-6) to ensure a realistic chance of accomplishment within a semester.
6. **Measurable:** COs must be specific enough to be measurable and assessable [3].

III. Guidelines for Framing Course Outcomes

General guidelines for framing COs include:

- The COs must state the major **knowledge, skills, attitude, or ability** the students will acquire.
- They should be assessable and measurable.
- COs must be expressed in terms of measurable and/or observable performance behaviors.[7]

- COs must be acceptable to, and preferably framed by, the faculty in a program, and should collectively yield the program outcomes.
- COs should begin with an **action verb** (e.g., write, install, solve, apply) for which Bloom's Taxonomy can be referenced.

- It is beneficial to map the COs to the learning domains in Bloom's or another relevant Taxonomy.
- It is generally recommended to identify between four and seven COs [2].

All courses in a program will have their own COs, which are designed based on the requirement of the POs.[9] Each CO is mapped to a relevant PO, which in turn is mapped to the PEOs.

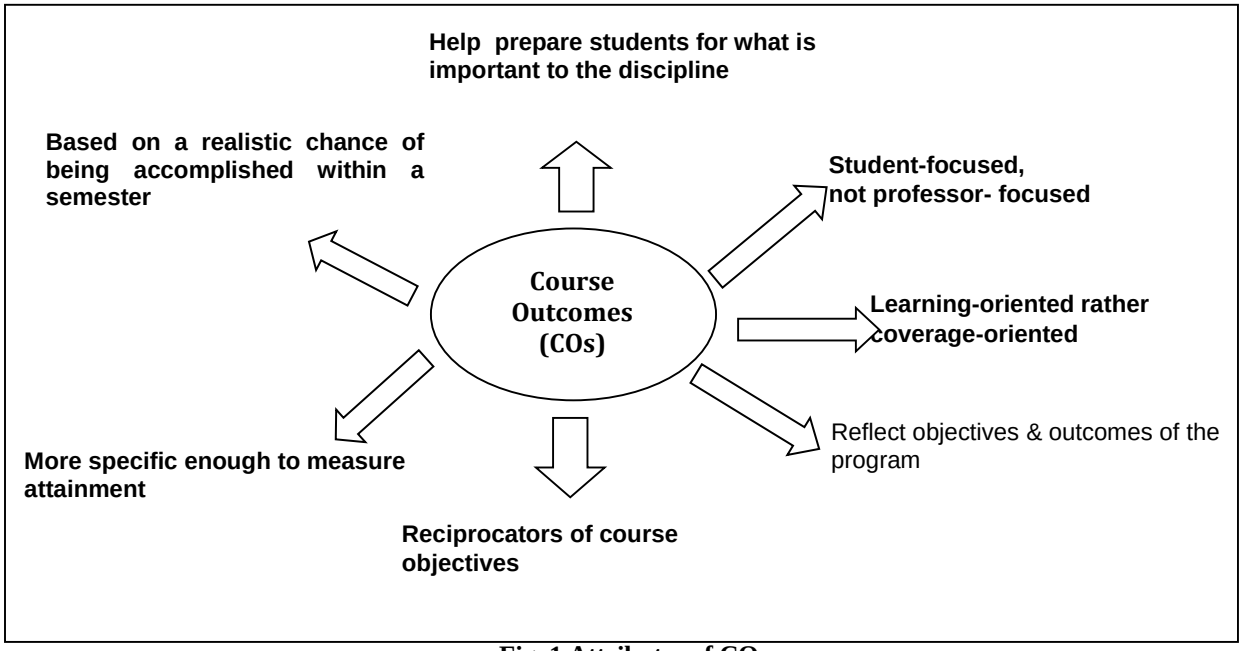

Fig. 1 Attributes of CO

A. The Novel Model for Simplification

A general practice is to rely on co-curricular and extracurricular activities as the primary means to assess and attain POs related to skills, behavior, values, and attitude. However, NBA expects COs to be framed based on Bloom's Taxonomy. The proposed model suggests that all four dimensions of Graduate Attributes can be satisfied more effectively if the COs themselves, along with teaching tools and techniques, are set based on these dimensions.[3]

The steps for implementing this model are:

1. **Divide the 12 Graduate Attributes (GA)**, as suggested by the Washington Accord, into four distinct classes:
   - **A) Knowledge**
   - **B) Skills**
   - **C) Behavior**
   - **D) Attitude and Values**
   -
2. **Assign Numerical Indexing:** Assign a number to each GA (e.g., A.1, A.2, B.1, B.2, C.1, D.1) based on the class it belongs to.

3. **Frame and Designate POs and COs:** Frame Programme Outcomes (PO) and Course Outcomes (CO) based on the four classes (A, B, C, D). If more than one is required per class, designate them as A1, A2, etc. The letter signifies the class of GA upon which the PO or CO is based.
4. **Process Simplification:** This systematic division and indexing simplifies mapping, assessment tool selection, and evaluation, ultimately increasing the overall attainment of POs and PEOs.

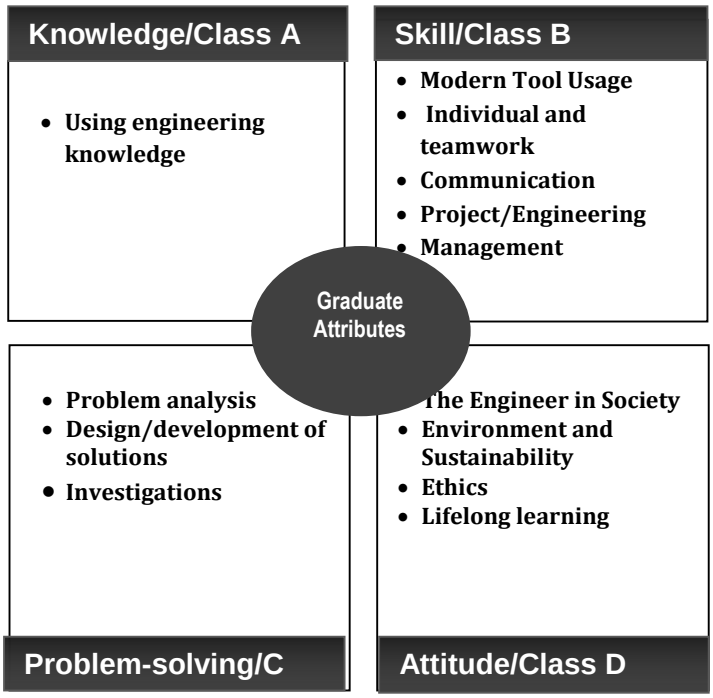

Fig. 2 Four classes of GA

IV. Mapping

Mapping is the process of representing the correlation among parameters, preferably in a matrix form (one-to-many, many-to-one, etc.) [4].

In the proposed system of nomenclature, mapping becomes simple and highly significant . Each class of CO naturally relates to its respective class of PO and PEO. Since COs are already divided into four classes based on GAs, their mapping to GAs, POs, and PEOs is greatly streamlined.

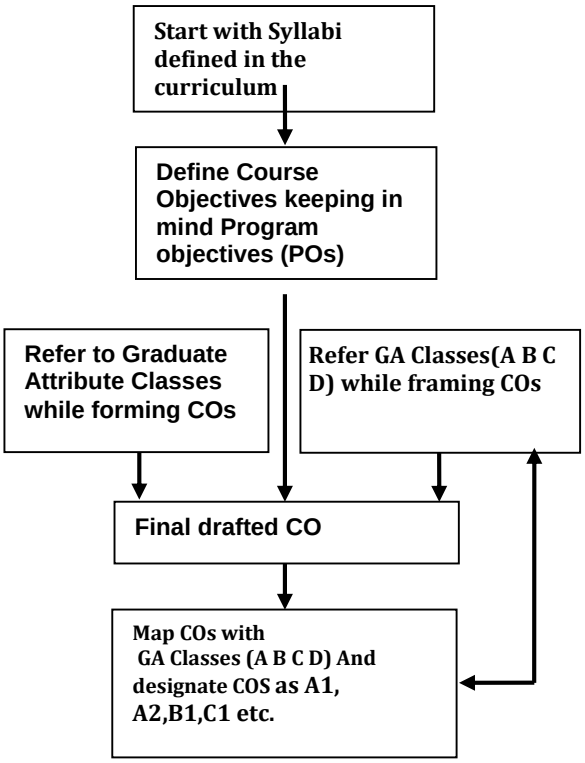

Fig. 3 steps for framing and designating CO

V. Assessment Tools

Assessment is the process of characterizing what is achieved. At the course level, it explores what students have learned; at the program level, it verifies student mastery of a knowledge domain [4]. Assessment is the systematic process carried out by the institution to identify, collect, and prepare data to evaluate the achievement of PEOs and POs [5].

Effective assessment methods are crucial for improving student learning. The results of CO attainment are used to evaluate PO attainment and to improve teaching and learning experiences. The teaching-learning process and assessment methods must be designed to achieve the COs [2].

		Program Outcomes							
		PO1	**PO2**	**PO3**	**P4**	**PO5**	PO6		
A	**A1**							**GA1**	**GRADUATE ATTRIBUTES**
	A2							**GA2**	
	A3							**GA3**	
B	**B1**							**GA4**	
	B2							**GA5**	
	B3							**GA6**	
C	**C1**							**GA7**	
	C2							**GA8**	
	C3							**GA9**	
D	**D1**							**GA10**	
	D2							**GA11**	
	D3							**GA12**	
		PEO 1	**PEO 2**	**PEO 3**	**PEO 4**	**PEO 5**	**PEO6**		
		Program education objectives(PEOs)							

Fig. 4 steps for framing and designating CO

Assessment Tool Selection based on CO Class:

Assessment tools can be effectively selected based on the class of CO they are intended to measure:

- **Class A (Knowledge) & B (Skills): Direct Assessment Tools** such as assignments, tests, laboratory work, presentations, tutorials, and exam performance are most appropriate.
- **Class C (Behavior) & D (Values and Attitude): Indirect Assessment Tools** such as rubrics, generics (e.g., peer assessment), alumni feedback, and course-end surveys should be considered.

Implementation Steps for the Generalized Model:

1. Use the PO list and CO list indexed with the four classes (A, B, C, D).
2. **Decide Mode of Delivery:** For each class of CO, decide the most appropriate mode of delivery. The nomenclature itself helps in selecting the delivery mode accurately (as shown in Table 1).
3. **Select Assessment Tools:** For each CO, select different assessment tools based on the delivery mode (Table 1). The contribution of each tool to the respective CO attainment can be weighted.

4. **Set Target Levels:** Define clear target attainment levels for each delivery mode, tool, and CO.
5. **Calculate Attainment:** Calculate individual student's attainment level and then total levels.
6. **Refinement:** Attainment of PO can be further increased by detailed analysis. COs can be divided into different measurable elements, and Performance Indicators (PIs) selected based on Bloom's Taxonomy for each element . This division helps in selecting the most appropriate assessment tools.

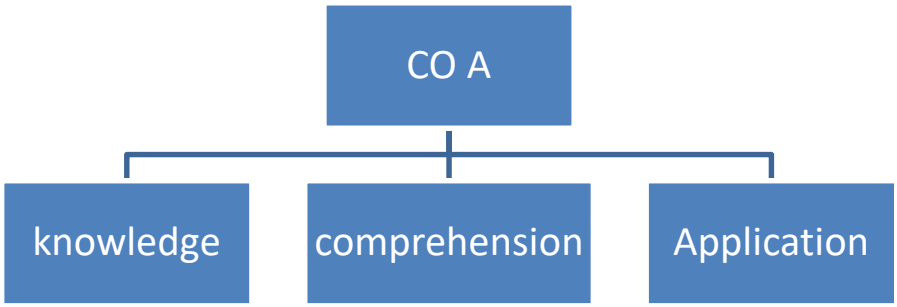

Fig. 5 Elements of CO

VI. Evaluation

Evaluation is the process of interpreting the data and evidence accumulated through assessment practices. It determines the extent to which PEOs or POs are being achieved and results in decisions and actions to improve the program [6]. The most common method is **course-embedded measurement**, using data from continuous assessment tests, end-semester examinations, assignments, laboratory exams, and project reports.

The use of various assessment tools allows for finding the attainment level for each type of goal set. This can be done by calculating the attainment level for every student, for individual assessment tools, across different types of delivery modes adopted for various GA classes. Since GAs and COs are divided into four classes based on their nature, the appropriate delivery mode and assessment tools can be easily selected and made common across the department. This consistency eliminates ambiguity among faculty members. Because the delivery mode and assessment tools are appropriate and accurate, the attainment level reflects the true percentage levels of goals achieved.

Table 1. Methods of Assessment Modes & Tools

PO Class	**CO Class**	**Delivery Mode**	**Assessment Tools**	**Goal Set/Target Level**	**% Attainment Level (Example)**
A	A.1	Lecture	Feedback, Survey, Tests, Mid, End Term Exam	60%	43%
	A.2	Laboratory	Tutorials, Practical & Oral Exam.	30%	20%
	A.3	Presentation, Group Discussions	Performance Sheets, Generics	10%	7%
Total A				**100%**	**70%**
B	B.1	Laboratory	Tutorials, Practical & Oral Exam. Rubrics	70%	55%
	B.2	Synchronou	Feedback,	30%	20%

		s, Video Sessions, Online Courses, Seminars, Webinars	Oral/Written Quiz		
Total B				**100%**	**75%**
C	C	Projects	Rubrics	80%	60%
		Technical Contests	Generics, Survey, Feedbacks	20%	10%
Total C				**100%**	**70%**
D	D	Cultural Events/Extracurricular Activities	Feedbacks, Term End Survey	60%	45%
		Social Activities	Feedbacks, Survey	40%	20%
Total D				**100%**	**65%**

Conclusion

For every higher educational institute, accreditation processes demand that faculty set course outcomes with clear target goals *prior* to instruction delivery and achieve maximum attainment levels with supporting evidence. This requires selecting appropriate assessment tools and evaluation methods.

The proposed novel model, where the expected Graduate Attributes (GA) are divided into four sub-classes (Knowledge, Skills, Behavior, and Attitude/Values), and all Programme Educational Objectives (PEOs), Programme Outcomes (POs), and Course Outcomes (COs) are framed and indexed based on these classes, significantly simplifies the entire process. The model makes the selection of the delivery mode, assessment tools, and the evaluation of attainment levels easier and more accurate. By systematically considering all GAs while framing COs, the maximum objectives of quality education, as prescribed by accreditation norms, can be achieved, thereby enhancing the institute's standards in the global market.

Acknowledgment

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