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Systematic approach of measuring program outcomes of management postgraduate program

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This study aimed to develop a simplified approach for measuring the outcomes of academic programs. To achieve this, postgraduate management programs offered by various Indian institutions have been selected. Program outcomes (POs) and course outcomes (COs) are key measurement constructs. The course assessment strategy is tailored to the nature of each course, which is categorized into four distinct groups. Course outcomes (COs) of continual evaluation courses are measured through developed rubrics. This study concludes that a systematic assessment process and well-designed measurement tools are important for measuring program outcomes (POs) of academic programs such as management postgraduate programs. We recommend our model of measuring learning outcomes for all institutions, where the management postgraduate programs offered courses are evaluated on three components: faculty assessment, mid-semester assessment, and end-semester assessment. This process ensures a comprehensive and accurate measurement of program outcomes.

KEYWORDS

outcome based education, learning outcomes, program outcome, course outcome, attainment of learning outcome, management studies

1 Introduction

The concept of OBE provides a clear and precise definition of the knowledge and skills students must acquire and accomplish by completing a course or program. This facilitates the establishment of exact goals and objectives, enhancing the educational process by increasing its concentration and goal-directedness, and benefits both educators and learners. The learner-centric educational philosophy is the foundation of outcome-based education (OBE), and it stands on the strong pillars of specific, quantifiable, and observable learning outcomes that learners are expected to attain (Tan et al., 2018). Predefined outcomes enable educators to create tailored learning experiences that accommodate each student's unique needs, capabilities, and learning preferences, fostering inclusivity and enhancing student engagement. By utilizing predetermined results, evaluating and appraising student achievement and institutional efficiency becomes more streamlined, guaranteeing the fulfillment of educational benchmarks. Precise delineation of learning objectives facilitates improved transmission of expectations between educators and learners.

OBE focuses on measurable goals, where learners' expectations are aligned with results; it also emphasizes customization and flexibility in learning. OBE is always open to contentious

improvement. Since its inception, it has enhanced learners' engagement and endeavors to align learning with practical, real-life scenarios, equipping learners with skills and knowledge essential for their future professional endeavors and overall life success (Driscoll and Wood, 2023). The original OBE philosophy focused only on the percentage of students who achieved their goals. Today, it also emphasizes evaluating educational programs' success using various metrics, such as improving human intelligence, raising the standard of human capital in a nation, and cultivating employability through the development of a variety of skills. In addition, OBE aims to foster entrepreneurial skills, which are highly valued in the current environment (Driscoll and Wood, 2020).

OBE advocates continuous assessment and feedback to track student advancement and adapt instruction and curriculum as needed to enhance learning and underscores accountability across all educational tiers, encompassing educators, institutions, and policymakers (Rao, 2020). OBE takes a student-centric approach to teaching; the components of OBE, such as learning outcomes, curriculum design, and assessment methods, are aligned to achieve learning outcomes (Yasmin and Yasmeen, 2021).

OBE has also faced many challenges. The clarity of learning outcomes is always debatable, and the diversity of assessment instruments within academic institutions makes outcome measurement more complex. Motivating students to take responsibility for their education and actively participate in the learning process might be difficult. Some students may find it challenging to learn independently or become overwhelmed by the emphasis on results, particularly if they assume that exams hold significant weight. Modifying OBE concepts to fit different learners' demographics, educational environments, and cultural situations requires tact and adaptability. The relevance and efficacy of OBE programs can be increased by considering cultural norms, linguistic variety, and contextual elements.

Demanding rigorous training for educators to transition from conventional teaching methods to an outcome-oriented approach may be time-consuming and resource-intensive. Measuring specific learning outcomes, particularly skills related to critical thinking and complex reasoning, can be challenging and necessitate creative assessment methods. Transitioning to outcome-based education (OBE) necessitates a significant change in the culture of educational institutions, which may encounter opposition from educators and administrators who are accustomed to conventional approaches. Students may need help adjusting to a novel learning approach that emphasizes their accountability for achieving desired learning results.

1.1 Indian viewpoints regarding outcome-based education (OBE)

The Washington Accord (WA), created in 1989 by six nations—Australia, Canada, Ireland, New Zealand, the United Kingdom, and the United States—was the source of OBE. OBE has notably expanded in India, encompassing all programs regulated by the All India Council for Technical Education (AICTE). This broad implementation underscores the commitment of Indian educational authorities to aligning curricula and assessment practices with clearly defined learning outcomes, fostering a more outcomes-driven approach to education across technical disciplines (Gurukkal, 2020). India, which

has one of the biggest higher education systems in the world, has been implementing significant changes to align it with international norms and generate more quality professionals who are prepared to satisfy the demands of society and the professional skills market (Asim et al., 2021). Regulatory bodies such as the University Grants Commission (UGC) have introduced guidelines to promote OBE, with bodies like the National Assessment and Accreditation Council (NAAC) and the National Board of Accreditation (NBA) ensuring its consistent implementation nationwide. Institutions are mandated to seek approval for their programs and courses, demonstrating adherence to OBE principles.

This study aimed to develop a systematic approach to measure the learning outcomes of management science students at the postgraduate level. We have organized this study into six sections. The first section is an introduction; the second section reviews previous research studies to better understand the evolution and significance of outcome-based education and the existing tools for measuring learning outcomes in outcome-based education. The methodology adopted for this research is covered in the third section. The fourth section of the study is to design the key measurement framework for measuring learning outcomes of management postgraduate programs in Indian settings. The data analysis and discussion part is summarized in the fourth section. The research is discussed and concluded in the fifth section.

2 Review of literature

William J. Spady promoted OBE, an educational philosophy, in the 1990s, primarily to improve the standard of instruction in the American school system. Then, OBE was extended to higher education institutions (Rao, 2020). Through explicitly defined learning outcomes, OBE is characterized as a structured and planned system of instruction in which the information, abilities, and competencies that students must possess upon leaving the institute are predetermined (Spady, 1994). OBE emerged as an organized, logical, design-down deliver-up, student-centered, and backward integrated framework to enhance education delivery because the traditional education system is not meeting the industry demands of the 21st-century skills and competencies (Kamal and Latip, 2009; Akir et al., 2012; Khanna and Mehrotra, 2019; Rao, 2020).

The holistic approach of OBE is presently embraced by educational institutions around the globe, culminating in a paradigm shift in the entire educational system on account of its comprehensive outlook of strategizing the program and instructional efforts to deliver quality education (Khanna and Mehrotra, 2019; Katawazai, 2021). OBE is a learner-centric procedure that promotes continuous attention as it is based on the student's capacity to demonstrate mastery of pre-established learning outcomes, which serve as a means of achieving program objectives (Khanna and Mehrotra, 2019; Driscoll and Wood, 2023). Outcomes-Based Education (OBE) emphasizes the importance of clearly defined program and course outcomes because program and course outcomes provide a clear understanding of what students should know, understand, and be able to do upon completion of a program or course (Rajak et al., 2019).

Outcomes also serve as a roadmap for curriculum development and instructional design. A professionally structure outcomes provide measurable criteria for assessing learners learning. This allows educators to gauge the effectiveness of their teaching methods and the

extent to which learners have achieved the desired learning outcomes. Learners are expected to achieve outcomes-based education, which enhances accountability at both the institutional and individual levels. Institutions can demonstrate the quality of their programs by showing evidence of learner's achievement of outcomes, and students can track their progress and take ownership of their learning; OBE also promotes a culture of continuous improvement by encouraging educators to regularly review and refine programs and course outcomes based on feedback from stakeholders, changing educational trends, and advancements in the field [Gurukkal \(2020\)](#). Clearly, articulated outcomes allow for flexibility in teaching methods and assessment strategies. Educators can adapt their approaches to meet the diverse needs and learning styles of students while still ensuring that the intended outcomes are achieved.

[Tan et al. \(2018\)](#) and [Pradhan \(2021\)](#) explained the importance of program outcomes (POs) and course outcomes (COs) and explained that the POs and COs serve as a common language for communication. OBE's teaching and learning activities are designed and carried out by the Program outcomes (POs), which are particular characteristics or qualities the student must possess to be eligible for the program ([Soragaon and Mahesh, 2016](#)). [Premalatha \(2019\)](#) developed a methodology of mapping POs with the course outcomes (COs) and concluded that the COs formulated as Blooms Taxonomy can be correlated with the POs, based on the component analysis. The correlation is usually expressed on a 3-point scale, where 0 or '−' indicates no correlation, 1 indicates mild correlation, 2 indicates moderate correlation, and 3 indicates strong correlation.

2.1 OBE and management education

Graduate employability rates are greater in management programs that have used OBE, according to [Chen et al. \(2023\)](#). One important component is the emphasis on industry-relevant skills and competencies. According to research by [Zhao and Li \(2021\)](#), because OBE-based management programs emphasize practical and relevant learning, its students tend to report higher satisfaction levels. [Brown and White \(2022\)](#) emphasize the need for ongoing professional development for faculty to implement OBE in management studies effectively. This includes training in new pedagogical methods and assessment strategies.

[Saha et al. \(2023\)](#) compared the qualitative approaches employed in OBE with traditional methods of management education. They came to the conclusion that OBE is beneficial for fostering the development of a particular set of skills needed by management professionals, including foundational knowledge, problem-solving abilities, research abilities, technical abilities, social skills, ethical values, communication abilities, project management abilities, and lifelong skills that have a big influence on one's career. [Peng \(2022\)](#) used a variety of OBE teaching techniques in mathematics business management courses, including financial management and data analytics, and concluded that these techniques, which include result orientation, inquiry, and discussion-based learning, are highly beneficial. [Lorenzen \(2021\)](#) reviewed the past literature and directed his efforts toward investigating the implementation of OBE in teaching modern information technologies and management. In their study on OBE applications in engineering education in India, [Jadhav et al. \(2020\)](#)

emphasized the value of perfect order in curriculum design, CO formulation, and assessment and evaluation procedures, which are widely applicable in higher education.

2.2 Implementation challenges of OBE

Considerable research has been done over the past years to address the issues surrounding outcome-based education (OBE). This overview summarizes the main themes and takeaways from the most recent research.

According to [Harden \(2020\)](#), it can be challenging to define learning outcomes that are both measurable and feasible as they need to explicitly state what students should know and be able to perform. [Bawa \(2021\)](#) states that educators frequently reject OBE in favor of conventional pedagogical approaches because they are unfamiliar with and lack knowledge of the approach. According to [Rahman et al. \(2022\)](#), students also show resistance, especially if they are not sufficiently prepared for the transition from conventional to outcome-based learning approaches. The increased accountability placed on students for their education is frequently the cause of this resistance.

[Smith et al. \(2022\)](#) argue that developing assessments that accurately measure complex competencies remains challenging. They advocate for innovative assessment methods, including project-based and peer assessments, to capture a broader range of student abilities. The difficulty of creating inclusive curricula that meet the needs of a diverse student body with a range of learning styles and experiences is covered in research by [Patel et al. \(2021\)](#). To accommodate this variability, evaluation and teaching strategies must be flexible. The conflict between the lax criteria set by accrediting agencies and the flexibility demanded by OBE is covered by [Williams and Taylor \(2021\)](#). They demand more communication and coordination between certifying bodies and educational institutions. The problem of striking a balance between flexibility and uniformity is addressed by [Green and Black \(2022\)](#). Although standardization promotes uniformity, it may impede OBE courses' flexibility and creativity. According to [Damit et al. \(2021\)](#), the main obstacles to applying OBE are inadequate training, outdated curriculum, broken COs, and improper assessment techniques.

2.3 Research gaps

OBE has been studied widely in recent years as a promising educational model and has proved effective in various areas of skills, competencies, and academic achievements. The Indian National Board of Accreditation (NBA) and National Assessment and Accreditation Council (NAAC) were instrumental in introducing outcome-based enrolment (OBE) in the higher education sector of the country. The NBA has developed a well-crafted process for measuring program outcomes for engineering education. The adoption of OBE system in management education seems to be based on ill-defined guidelines, which makes it challenging to gauge the extent of impact of OBEs. Additionally, the literature currently in publication is unclear about precise calculation techniques for objectively valuing these various parameters, which can result in biases that could be prevented because of the subjective judgments of the authors.

3 Research methodology

This study is an improvement and methodical summary of the current instruments for gaging the learning outcomes of graduate-level management programs. For instance, rubrics are already developed for assessment tools for academic projects and seminars (Reddy and Andrade, 2010; Moreno Oliver and Hernández-Leo, 2015). Muhammad et al. (2018), our research has mediated the project and seminar rubric evaluation of management education programs. We have developed the following methodology for developing an improvised approach for the measurement of POs of management postgraduate programs.

3.1 Problem definition

Measuring learning outcomes is an essential element of outcome-based education. The aim of this study was to identify the simplistic approach to attainment calculations for learning outcomes of management postgraduate programs.

3.2 Literature review

We have reviewed the comprehensive available literature. We have tried to review the maximum available literature during recent years.

3.3 Variable selection

The proposed method for calculating attainment is founded on two fundamental elements: course outcomes and program outcomes. The development of the model logically elucidates the instruments used for measurement.

3.4 Model development

A four-step attainment calculation model has been devised, centered on two primary concepts. The initial step involves elucidating the procedure for quantifying the alignment between program and course outcomes. The subsequent step entails aligning course outcomes with examination question papers across different instances of the same course. The third step delineates the comprehensive process of achieving course outcomes, while the fourth step focuses on achieving program outcomes.

4 Outcome-based education measurement framework for management postgraduate programs

The outcome learning outcome outcomes measurement starts by clearly demonstrating the academic institution's mission and vision statements, which explain its guiding principles and long-term objectives. The outcomes of the offered academic programs are created to be consistent with these declarations that we ensure our educational offerings directly contribute to the larger institutional goals (refer to

Figure 1). This process of alignment, which begins with clear communication of the aims of the institution to all relevant stakeholders—learners, staff, employers, and the society, is a testament to their value and integral role in our institution. It also demonstrates how every course and program advances accountability and openness inside the institution by supporting its overarching goals. Research also indicates that for educational delivery to be coherent, there must be a clear connection between the vision, goal, and program objectives of the institution.

Alavi and McCormick (2022) assert that this alignment guarantees a direct contribution from the educational programs to the long-term goals and objectives of the institution. Jones and Brown (2023) emphasize that this alignment supports continuous improvement processes, allowing institutions to systematically review and refine their programs to ensure they remain relevant and effective. According to Harris and Jones (2021), for institutions to be relevant, they must periodically review and modify their vision, mission, and program results due to the dynamic nature of higher education and the changing requirements of society.

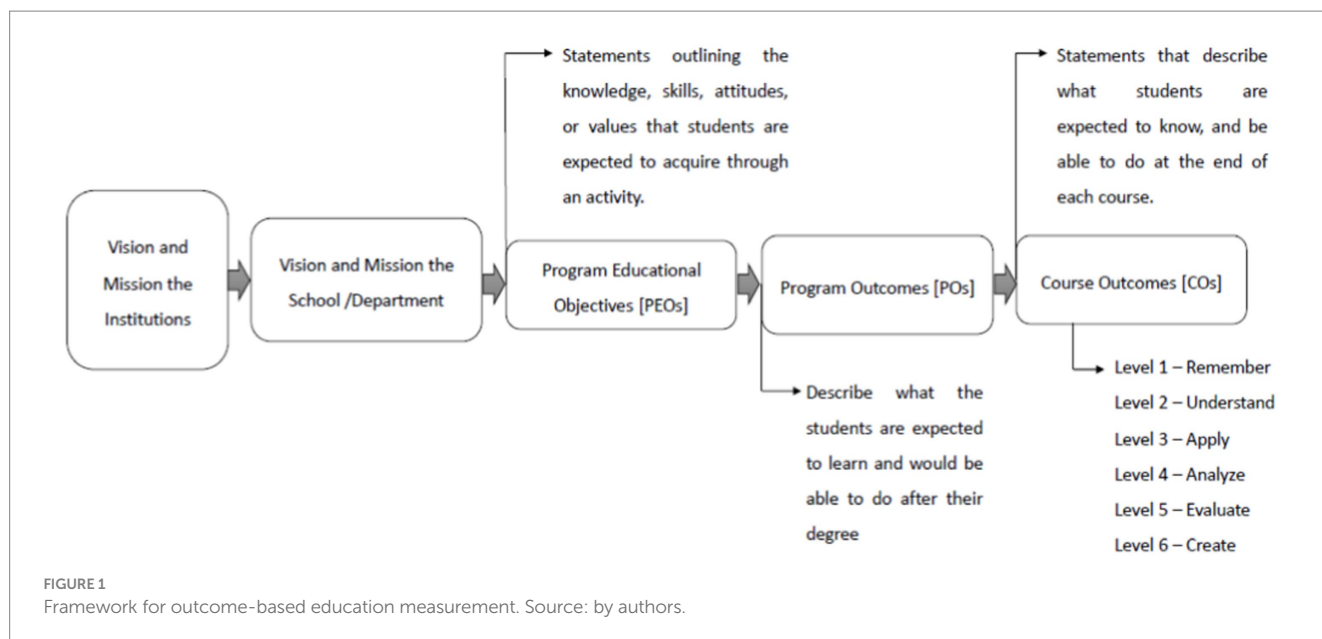
Educational objectives (PLOs), although the key measurement construct in OBE is course outcomes (Cos). It is essential for the department or school offering the program to ensure alignment between its vision and these outcomes. PEOs, defined as knowledge, skills, attitudes, or values, define what students will know or be able to do as a result of completing an educational program. Wiggins and McTighe (2021) discuss the backward design approach, in which teachers create course outcomes and assessments to support program outcomes after starting with the end in mind. This guarantees that every course significantly contributes to the program's goals of the program.

According to Davis (2022), for COs to properly support POs, they need to be precise and quantifiable. Precise and unambiguous COs facilitate improved evaluation and program goal alignment. They should be measured and observable when appropriate (Balasubramani and Chiplunkar, 2017). They ought to be written in a way that makes sense to teachers, staff, students, administrators, and other stakeholders. Every set of results should be thorough, well-organized, and appropriate for the subject. Program outcomes (POs) are another main construct after COs for measuring learning outcomes; POs are the particular knowledge, skills, and abilities that students are expected to gain or exhibit by the time they finish the program are referred to as program outcomes in educational programs (Blackburn et al., 2024). These objectives, which are generally specified by the schools/department running the program, act as standards by which to measure how successful the learning process is, in Indian context, regulating and accrediting agencies have also specified the POs of the various higher educational institutions (Hicks and Bose, 2019).

Program results and course outcomes are comparable, but course outcomes are unique to a certain curriculum's courses; course outcomes divide the more general aims of a degree program into smaller, more manageable components that may be evaluated in the confines of a single course, while program outcomes offer a broad overview of what students should accomplish by the end of the program.

4.1 The assessment instruments and techniques

Assessment in OBE is based on learning outcomes of learners; multiple sets of tools are used to assess learning outcomes, such as



rubrics, performance tasks, observations, self-assessments, peer assessment tests and quizzes, interviews and oral examinations, and surveys and questionnaires. Assessment methods are performance-based, allowing learners to demonstrate their competence in real-world situations. This study has developed a unique set of tools based on the nature of the courses taught in management postgraduate programs. The courses are categorized into four categories (refer to Figure 2), theory courses (TCs), comprising core and electives and multidisciplinary courses. Learning outcome evaluation tools for TCs are predesigned, and sometimes these are approved through institutional internal quality approving centers.

A three-step evaluation approach is used for evaluating TCs: learners are evaluated in the middle of the semester or trimester and at the end of the semester through a blind evaluation method, and faculty assessment component of every TCs is evaluated through defined rubrics; rubrics are assessment instruments that provide explicit criteria and standards for judging a given job, project, or performance, such as assignments, quizzes, class participation, and class attendance in case of assessment of seminars in projects of management post graduate academic programs. Value-added courses (VACs) are another important set of course management studies, which include student seminars, career and life skill courses, and academic projects of learners. This study has designed a separate set of rubrics for VACs. Student seminars are divided into two components: seminar reports and seminar presentations; a comprehensive rubric sheet (refer to annexure: 1) is proposed. Career and life-skills training is crucial for management learners. These abilities boost their confidence and enable them to obtain high-quality professional experiences. Life skills enable people to adapt to the quick changes brought about by modernity.

4.1.1 Evaluation of student assignments

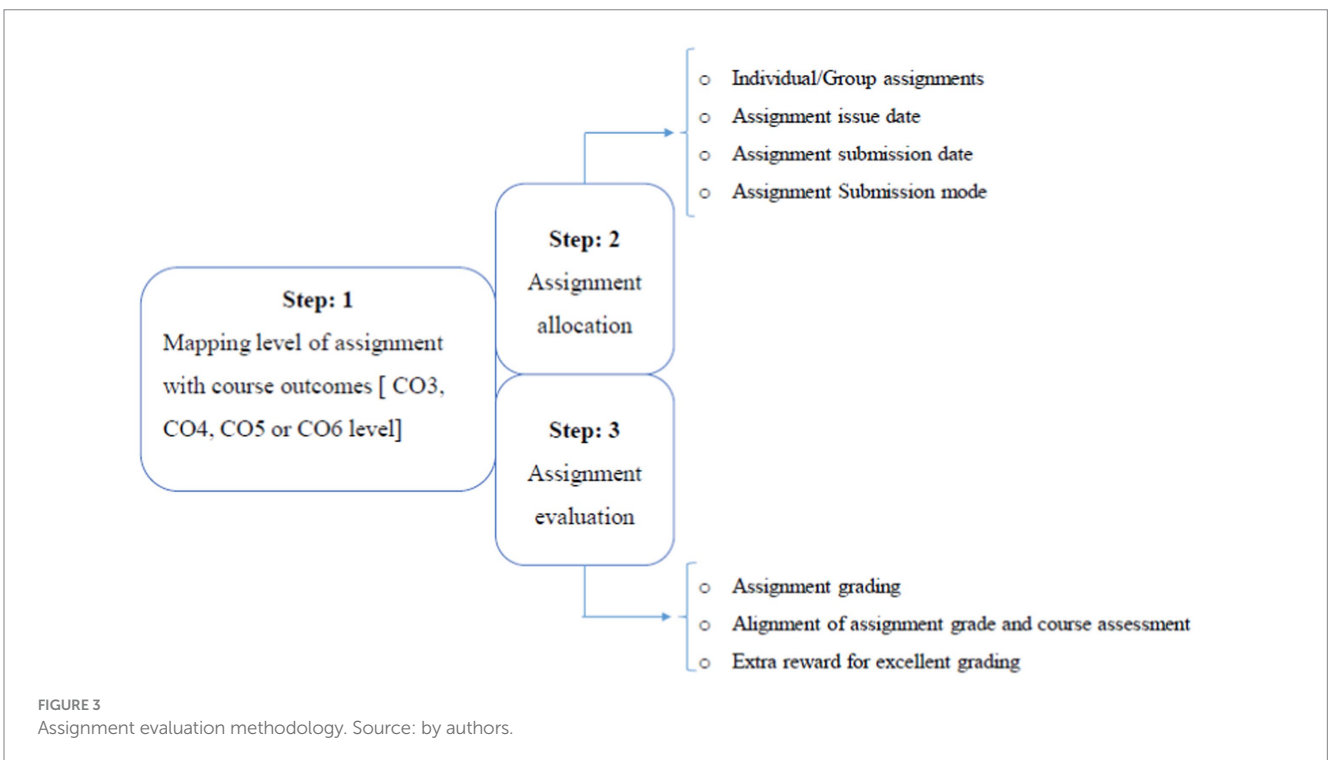
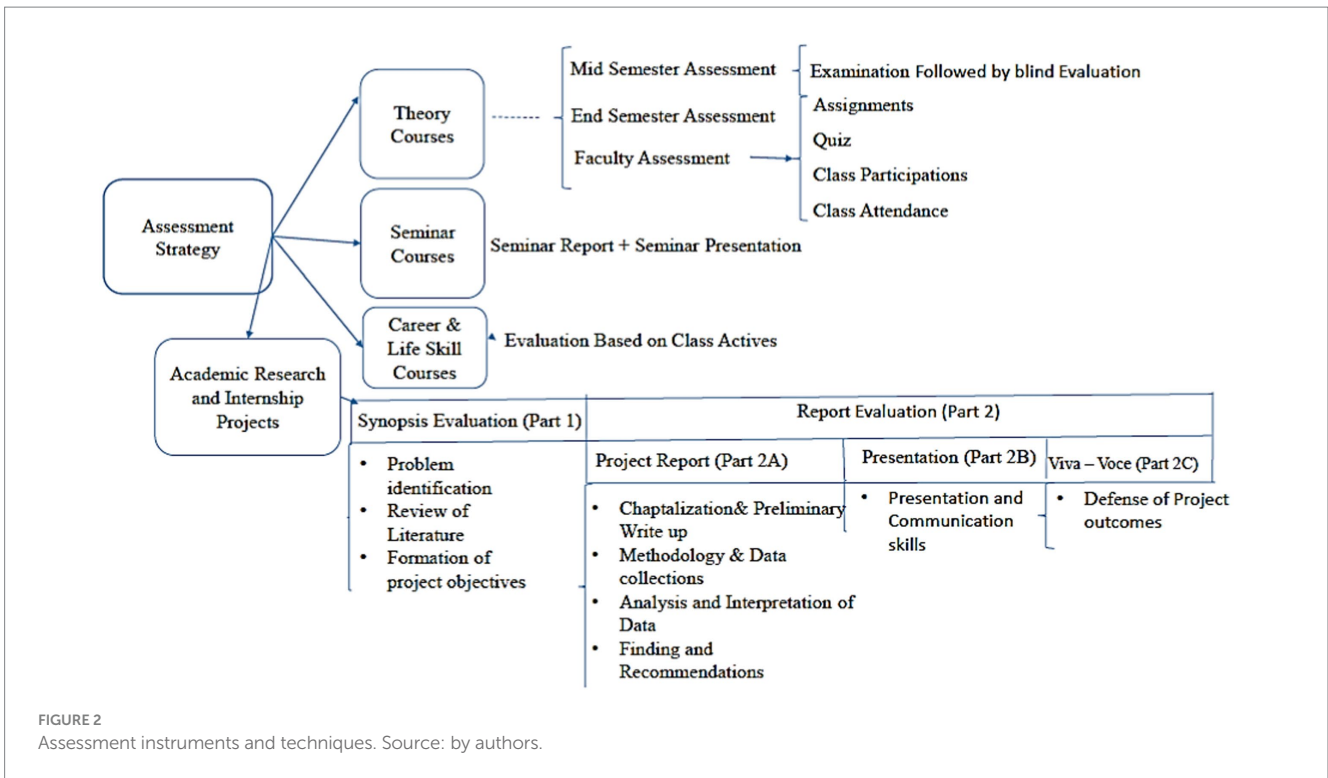
The suggested method outlines a three-step assessment of student assignments (refer to Figure 3). The first step focuses on determining the difficulty level and nature of assignments. We propose that assignments in a given course should be aligned with the learning

outcomes beyond the levels of CO1 and CO2 for that course; assignments should take the form of case studies, small-scale field studies, or analyses that are either analytical or descriptive. In the second step of our approach, we detail the elements involved in assigning tasks, requiring the course mentor to determine whether the assignment should be completed individually or in groups. Group assignments foster teamwork skills. Additionally, the mentor must carefully consider the time frame between assignment issuance and the submission deadline, taking into account the assignment's complexity and nature and the chosen mode of submission. The third step begins with grading assignments and ensuring assigned grades are appropriately integrated into the overall course assessment. Offering additional incentives for well-graded assignments can boost overall course achievement.

4.1.2 Evaluation of academic/internship projects of learners

Engaging in academic projects offers learners the chance to put into practice the theoretical knowledge acquired in the classroom, bridging the gap between theory and real-world applications. Such projects cultivate a distinct set of skills including critical thinking, research acumen, adeptness in project management, collaborative teamwork, effective presentation and communication abilities, as well as the fostering of creativity and innovation (Karunaratne and Perera, 2019).

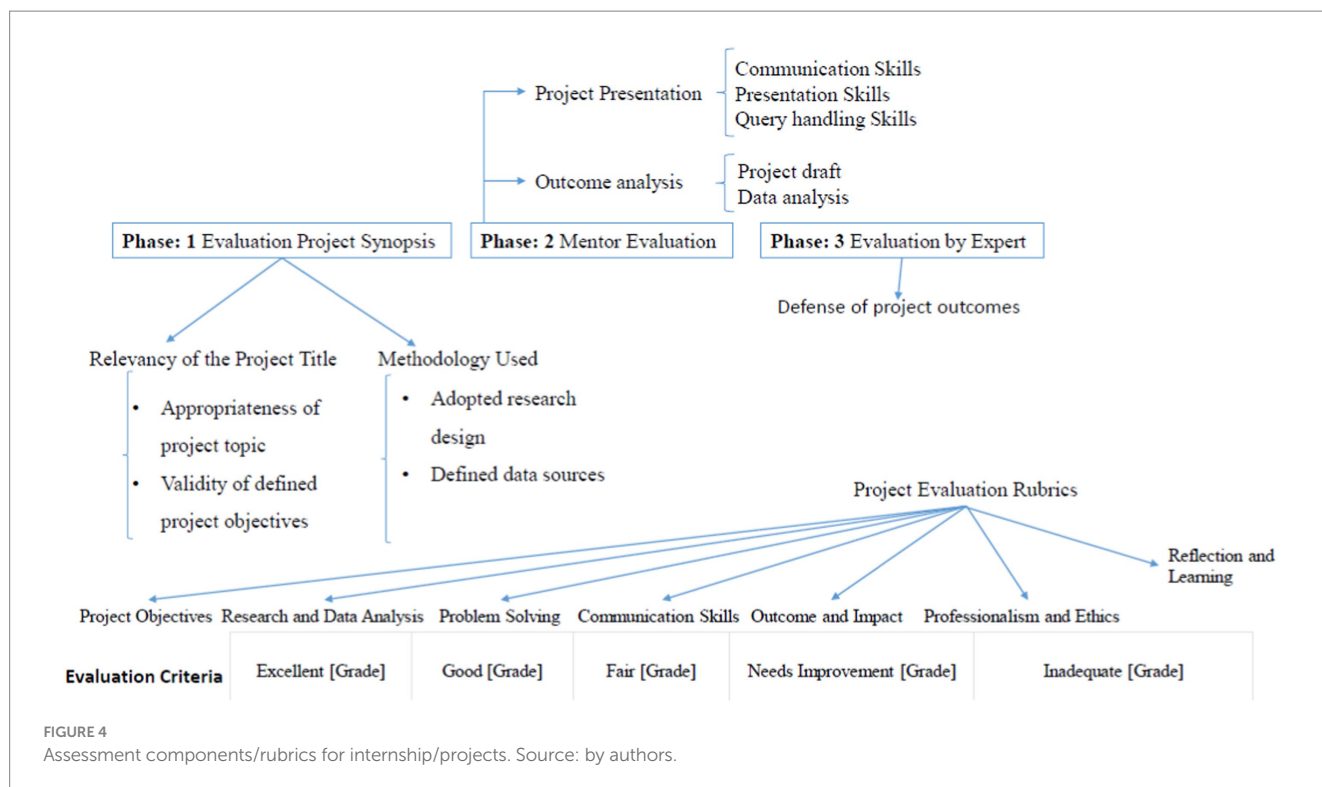
We have designed a three-phase simplistic framework for evaluating academic projects of management learners (refer to Figure 4), synopsis evaluation is the first phase which comprises five assessment components in two subphases, a major focus of first phase assessment relevancy of project title and accuracy of methodology adopted for achieving project objectives. Phase two is the internal evaluation means the emulation of the project through the project mentor. The project mentor evaluates two aspects of the project in this phase: first one is the aspects related to data analysis and its interpretation and evaluation components are methodology and data collection techniques, justification of objectives findings and



recommendation, and capitalization. Second aspect of project evaluated by project mentor is the project demonstration skills of learner. Experts from outside academic institutions complete the third step of the project evaluation; these experts may also be from relevant industry. The learner is expected to present a strong case for the project work at this phase.

5 Analysis and discussion

The outcomes-based model mandates that outcomes be measured and looks for proof that these measurements have aided in the promotion of a process of quality improvement. Quantifying the level of program attainment enables outcome-based education (OBE) to



be multidirectional, aiding in the identification of gaps between established and achieved objectives. These identified gaps can be addressed through enhancements to program outcomes level, adjustments to the mapping of program and course outcomes, and refinement of question paper mapping. A straightforward four-step approach to attainment calculation is recommended for assessing program outcome achievement.

5.1 Step: 1 mapping of program outcome with course outcome

The quantification of learning outcomes starts with mapping the program outcomes with course outcomes. The first program outcome of the management postgraduate program as suggested by National Board of Accreditation (NBA) is “Apply knowledge of management theories and practices to solve business problems”; next task in quantification is to identify the competence level of this PO (refer to Figure 5); each competency level will be identified by its performance indicator. Various courses of offered in program and each courses have its course outcomes. For mapping, CO1 of a course will be mapped with the performance indicators of first competence level of PO1, numeric 1 will be assigned for mapped, and 0 will be assigned for not mapped and mapping strength will be calculated (refer to Figure 5). Correlation strength for each mapping strength will be decided by the internal quality control cell of the institutions. The same process will be repeated for all the program and course outcomes.

The process of quantifying learning outcomes begins by aligning program outcomes with course outcomes. The first program outcome (PO) for a management postgraduate program, as recommended by the National Board of Accreditation (NBA), is “Apply knowledge of management theories and practices to solve business problems.” To

quantify this program outcome, the next step involves determining the competency levels associated with this PO (refer to Figure 5). Each competency level is delineated by its performance indicators.

Within the program, various courses are offered, each with its own set of course outcomes (COs). To align CO1 of a course with the performance indicators of the first competency level of PO1, a numeric value of 1 will denote mapped outcomes, while 0 indicates unmapped ones. The strength of the mapping is then calculated (refer to Figure 5). In this context, CO1 is aligned with PI 1.1.1, 1.1.3, 1.2.2, 1.3.1, and 1.3.3, as indicated in Figure 5. A mapping is denoted by 1, while the absence of mapping is denoted by 0. The mapping strength between CO1 and PO1 is accurately determined using a binary mapping strength scale.

5.2 Step: 2 mapping of questioned paper with course outcomes

The procedure delineates the method for aligning question papers for mid- and end semester examinations. The proficiency levels of course outcomes are defined according to Bloom’s Taxonomy (Chandio et al., 2021). The question paper is structured to encompass all the course outcomes, and a supplementary file containing the mapped question paper is provided. A hypothetical mapping of COs is explained in Table 1. Question 1 section B of mid-semester and question 2 section A are designed at the level of CO1. Accordingly, question 2 sections A and B of mid-semester and question 3 section A of end semester examination are mapped at the CO2 level. It is not necessary that every questions must be divided into sections; single-section questions are also asked. This exercise is repeated for all possible COs and the number of questions in mid- and end semester examinations. One question may be mapped for more than one

TABLE 2 CO-wise grade point.

Students ID	CO-Wise Grade Point								
	CO2								
	Question 1[A]			Question 1[B]			Faculty/internal assessment		
	MO	MM	GP	MO	MM	GP	MO	MM	GP
101	4	10	0.4	2	10	0.2	13	25	0.5
102	0	10	0	3	10	0.3	12	25	0.5
103	0	10	0	5	10	0.5	11	25	0.4
104	6	10	0.6	0	10	0	15	25	0.6
105	2	10	0.2	0	10	0	18	25	0.7
106	3	10	0.3	5	10	0.5	13	25	0.5
107	0	10	0	0	10	0	10	25	0.4
108	2	10	0.2	0	10	0	16	25	0.6
109	7	10	0.7	0	10	0	17	25	0.7
110	9	10	0.9	0	10	0	12	25	0.5

TABLE 3 Question-wise marks.

Student ID	Mid-semester examination (MSE)										IA/FA
	Q1			Q 2			Q 3			Q 4	
	A	B	C	A	B	C	A	B	C		
101	4	2	0	0	0	8	5	5	0	6	13
102	0	3	4	7	7	0	3	3	0	8	12
103	0	5	6	5	5	0	0	4	4	6	11
104	6	0	0	6	6	0	0	4	4	7	15
105	2	0	4	0	0	8	3	3	0	5	18
106	3	5	0	5	6	0	4	4	0	0	13
107	0	0	0	8	8	0	5	5	0	0	10
108	2	0	8	0	0	0	6	6	0	2	16
109	7	0	8	6	6	0	0	0	5	3	17
110	9	0	0	4	4	0	0	6	6	6	12

GPs obtained for each group of questions. Here, the weights for each assessment method shall be taken as per the approval of the Academic Council for that Academic Year (AY).

As per data from Table 3 question-wise marks are allocated for all the learners enrolled in a particular course; in step 2 of CO attainment calculation, CO-wise grade points are calculated (Table 2); and question 1 is of choice-based (attempt any two of three); if the student 101 has attempted part A and part B, the methodology of GP calculation is $4/10 + 2/10 = 6/10 = 0.6$ (10 is the maximum marks for the options), so the AGP of Question 1 for student 101 is 0.6; accordingly, it can be calculated for remaining questions and learners.

In step 3 of CO attainment at course-level calculation, student cumulative performance in the form of AGP is arranged as per the overall grade points on a scale of 0–10, CO-wise percentage of students securing grade points in decreasing order (Table 4). The target attainment level is set at GP of 6, and the attainment values of CO1, CO2, and CO3 are calculated accordingly in Table 4.

5.4 Step: 4 measurement of program outcomes

The course outcomes map to program outcomes to varying extents, as described in the section on mapping of course outcomes with program outcomes, based on mapping strength as weights, the weighted average of the CO attainment shall be calculated. This is to be done at program level and the PO-wise attainment will be calculated as given in expression below

$$PO_j = \frac{\sum_1^n M_{ij} A_i}{n}$$

Where n is the number of COs that are mapped to PO_j , A_i is the attainment of i^{th} CO that is mapped to PO_j , M_{ij} is the mapping strength of CO_i and PO_j on 3-point scale.

TABLE 4 CO attainment.

CO-wise cumulative student performance			
Grade point	CO1	CO2	CO3
10	1.71	1.2	0
9	3.32	1.20	1.12
8	13.21	12.18	10.12
7	16.86	13.1	13.02
6	50.49	60.1	52
5	10.71	9.5	10.32
4	2.31	2.6	9.56
3	3.21	1.15	3.75
2	1.5	0.17	0.11
1	0	0	0
0	0	0	0
Attained value	$3 \times 0.5049 = 1.51$	$3 \times 0.6010 = 1.80$	$3 \times 0.52 = 1.56$

Through illustration, this can be easily explained as five learners score minimum or more 6 average grade point in CO1 (refer to Table 2) attainment of CO1 in this particular course in $0.5 \times 3 = 1.5$ and CO1 is mapping strength with PO1 is 2 (refer to Figure 5). The weighted of CO1 attainment in PO1 is $1.5 \times 2/3 = 1$. This procedure is repeated for all the COs and POs; finally, the attainment level of each PO is calculated for a particular course. Similar process is adopted for all the courses of the program, and attainment of final POs is calculated.

6 Conclusion, limitations, and future scope

The proposed systematic approach to measuring program outcomes in a management postgraduate program represents a comprehensive and dynamic framework aimed at ensuring the continuous enhancement of educational quality and relevance. By integrating both quantitative and qualitative measures, the approach provides a holistic understanding of the program's effectiveness, covering not only academic achievements but also the development of crucial managerial skills and the impact on career trajectories of learners.

A four-step attainment calculation model has been developed, predicated on two primary concepts. The initial step involves elucidating the procedure for quantifying the alignment between program and course outcomes. The subsequent step entails aligning course outcomes with examination question papers across different instances of the same course. The third step delineates the comprehensive process of achieving course outcomes, while the fourth step focuses on achieving program outcomes.

The proposed model of outcome attainment makes outcome-based education (OBE) very interesting quantification of learning outcomes helps in identification of gaps between set goals and accomplished goals. These gaps can be filled by raising the bar for program results, modifying how program and course

outcomes are mapped, and improving the mapping of question papers.

Stakeholders can obtain useful insights into the degree to which the program achieves its desired goals by utilizing a comprehensive framework that incorporates a range of assessment techniques and strategies. By identifying areas for improvement and areas of strength, this strategy promotes continual improvement and ultimately raises the standard of management education. Institutions may better serve their learners, set them up for future professional success, and improve the state of management education overall by implementing a methodical approach to measurement.

"Perfection does not exist" is a common phrase used for commonly, it becomes reality in all those established models which are based on market demands. Faculty play a crucial role in designing, implementing, and assessing educational outcomes, and quality human resource is lacking in the Indian higher education system. Although the OBE model is widely accepted by academic instructors across the globe, it has also some limitations. Sanyal and Gupta (2018) highlighted some of the laminations of OBE like it has a narrow scope because OBE focuses only on the measurable outcomes, OBE supports standardizations, and standardizations becomes a challenge for cultural and societal diversity, and another big limitation of OBE is its overemphasis on assessments which minimize the scope of flexibility. All the developed models of OBE encountered above-mentioned limitations (Rajae et al., 2013).

Ethics statement

The necessary ethical approval for this study was obtained from Department of Management Studies, Graphic Era Deemed to be University, Dehradun, India.

Author contributions

NB: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Software, Supervision, Validation, Writing – original draft, Writing – review & editing. AJ: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Software, Supervision, Validation, Writing – original draft, Writing – review & editing. MW: Writing – original draft, Writing – review & editing.

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Conflict of interest

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