

An Approach to the Evaluation of Program Outcomes and Consideration of Activities beyond Curriculum for Improvement of Program Outcome Attainment

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ABSTRACT

Current global scenario demands outcome based education to develop graduates with universal acceptability. Program Outcomes (POs) laid by NBA (Table 1) are the assessable components indicative of graduate potential to demonstrate competencies to practice at appropriate levels. Program Outcomes (PO) can be defined and calculated by assessment of various Course Outcomes (CO) which can further be evaluated from Learning Outcomes (LOs). Blooms Taxonomy classifies LOs into the cognitive, affective and psychomotor domains based on their level of complexity. Each LO maps to CO and hence contributes to PO. The direct and indirect assessment tools can be used to obtain course outcome attainment level. Performance at the prerequisite subject and attainment of the outcomes for previous year are the factors determining defined CO attainment. The attainment of Program Outcomes POs is an indicator of the graduate's potential to demonstrate competencies and practice at appropriate levels. POs are derived from the Graduate Attributes (GA) specified by the National Board of Accreditation (NBA). Curriculum designed by University is not enough for a graduate to achieve the desired level of PO attainment. PO attainment is calculated by considering co-curricular and extracurricular activities in addition to the curriculum specified by the affiliating University for a programmer. GA like Pharmacy Knowledge, Thinking Abilities, Planning Abilities, Professional Identity, Environment and Sustainability, Pharmacist and Society are achieved through regular curricular activities whereas other GA like Leadership Skills, Ethics, Communication and Life Long Learning can be better attained through participation in extracurricular and co-curricular activities. This paper describes a module for defining and calculating attainment of Program Outcomes. It also demonstrates how of Activities beyond Curriculum for improvement of Program Outcome attainment.

Key words: Blooms Taxonomy, Program Outcomes, Graduate Attributes, Program Educational Objectives, Co-curricular, Extracurricular.

INTRODUCTION

The efficiency and effectiveness of higher and technical education should be described in terms of learning outcomes rather than number of credits or number of hours. In a teacher-centered approach the teacher decides the content to be taught, accordingly plans the content and assesses the content that has been delivered. Whereas, in a student-centered approach a student is expected to know and be able to perform a task, at the end of a lesson. In other words the student is aware of the outcome of a particular

lesson. Learning Outcomes are statements of what a learner is expected to know, understand and/or be able to demonstrate after completion of a process of learning. A teacher should write very specific statements about observable outcomes expected of a student at the completion of every lesson as Learning Outcomes (LOs). The LOs for each module of a course are then grouped to define Course Outcomes (COs). Bloom's Taxonomy classifies LOs into three domains- Cognitive, Affective and Psychomotor. Most

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Table 1: Graduate Attributes and Program Outcomes defined by NBA for Pharmacy.¹

PO No.	Graduate Attribute	Program Outcome Description
PO1	Pharmacy Knowledge	Possess knowledge and comprehension of the core and basic knowledge associated with the profession of pharmacy, including biomedical sciences; pharmaceutical sciences; behavioral, social and administrative pharmacy sciences; and manufacturing practices
PO2	Planning Abilities	Demonstrate effective planning abilities including time management, resource management, delegation skills and organizational skills. Develop and implement plans and organize work to meet deadlines
PO3	Problem analysis	Utilize the principles of scientific enquiry, thinking analytically, clearly and critically, while solving problems and making decisions during daily practice. Find, analyze, evaluate and apply information systematically and shall make defensible decisions
PO4	Modern tool usage	Learn, select and apply appropriate methods and procedures, resources and modern pharmacy-related computing tools with an understanding of the limitations
PO5	Leadership skills	Understand and consider the human reaction to change, motivation issues, leadership and team-building when planning changes required for fulfillment of practice, professional and societal responsibilities.
PO6	Professional Identity	Understand, analyze and communicate the value of their professional roles in society (e.g. health care professionals, promoters of health, educators, managers, employers, employees)
PO7	Pharmaceutical Ethics	Honor personal values and apply ethical principles in professional and social contexts. Demonstrate behavior that recognizes cultural and personal variability in values, communication and lifestyles. Use ethical frameworks; apply ethical principles while making decisions and take responsibility for the outcomes associated with the decisions
PO8	Communication	Communicate effectively with the pharmacy community and with society at large, such as, being able to comprehend and write effective reports, make effective presentations and documentation and give and receive clear instructions
PO9	The Pharmacist and society	Apply reasoning informed by the contextual knowledge to assess societal, health, safety and legal issues and the consequent responsibilities relevant to the professional pharmacy practice
PO10	Environment and sustainability	Understand the impact of the professional pharmacy solutions in societal and environmental contexts and demonstrate the knowledge of and need for sustainable development
PO11	Life-long learning	Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change. Self-assess and use feedback effectively from others to identify learning needs and to satisfy these needs on an ongoing basis

higher and technical education programs have syllabi that satisfy the cognitive domain of learning directly through various courses at different levels. Average contribution of curricular content is seen towards development of the psychomotor domain and poor contribution to the affective domain.

Graduate Attributes (GA) and Program Outcomes (POs)

Graduate Attributes, defined by the National Board of Accreditation (NBA), are employability characteristics expected by a recruiting organization in a candidate on successful completion of the curriculum designed for a particular program. GAs is described as Program Outcomes (POs), which are specific and measurable statements that encapsulate the skills, knowledge and behavior that students should acquire throughout the

program. POs are crafted from the Program Educational Objectives (PEOs) which are to be embodied by the graduate three (3) to five (5) years after graduation and in turn are crafted from the Vision and Mission of the Institute. The level of attainment of the GAs, or in other words the POs, can be derived from the achievement of LOs which through the COs are mapped to the POs.

METHOD FOR CALCULATION OF CO AND PO ATTAINMENT²

For a given Program, the expected attainment of the outcomes needs to be defined quantitatively. The actual attainment is derived using several assessment tools on different units of the curriculum. This paper describes a method to assess the overall attainment of POs using defined expected attainment and calculated

actual attainment. Assessment tools are directly applied to curricular content, or we can say that these tools are applied to each course of a program, making assessment of COs the primary objective. It is therefore essential to define attainment at the level of each course itself, *i.e.* defined CO Attainment and then calculates its contribution to a particular PO based on its mapping. The average defined attainment of all courses that mapped to a particular PO specifies the expected level of attainment for that PO, *i.e.*, defined PO Attainment. Evaluation using the assessment tools on courses conducted will similarly provide the calculated PO Attainment.

A module in MIS (Management Information System) has been developed to capture data related to the assessment tools and their correlation to the POs. Data can be processed at several steps to identify the contribution of the various curricular activities and thereby assess the attainment of POs.

Assessment of Course Outcomes (COs)

a) Defined CO Attainment

Generally, performance levels of students at the end of an academic year are measured in comparison to the performance at the same level by other batches of students in the previous academic years. However, most often what is not taken into consideration is the performance at the level prior to that being assessed. It is therefore essential to capture these values to create a comparable parameter for assessing performance levels over different batches of students. Since the curriculum conducted for the batches of students is the same, the Defined CO Attainment is calculated for each course in each academic year as the average of the following (Table 2)

1. Result of pre-requisite course for the students being assessed
2. Result of the previous academic year for the course being assessed

b) Calculated CO Attainment

Learning Outcomes (LOs) for every course were classified, based on their level of complexity, into the six levels of the cognitive domain as defined by Bloom's Taxonomy. Each level was assigned an expected attainment value (Table 3). The % attainment value is the expected percentage of marks that a student should secure on attempting questions related to the particular level of Bloom's Taxonomy. The defined attainment decreases with the increasing complexity of the learning outcome. Assessment of the attainment of LOs is done

Table 2: Defined Course Outcome attainment.

Course being Assessed	Anatomy Physiology Pathophysiology I	Anatomy Physiology Pathophysiology II
Result of the previous academic year for the course being assessed	75.52 %	80.26 %
Pre-requisite subject	Biology at Std. XII	Anatomy Physiology Pathophysiology I
Result of pre-requisite course for the students being assessed	85.56 %	75.52 %
Defined CO Attainment	80.54 %	77.89 %

by mapping the questions asked in a written exam (the formal evaluation method for any program) to the level of Bloom's Taxonomy.

For assigning the percentage for each bloom taxonomy level as 70% is awarded as First Class with Distinction, we chose this as the highest level. Followed by 10% intervals for others.

The quantitative assessment for each LO is mapped to the respective CO. The average of all contributions from the various assessment tools is taken as the Calculated CO Attainment (Table 4).

Assessment of Program Outcomes (POs)

Each CO maps to POs with strong (100% Define and Calculated PO Value), medium (80% of Define and Calculated PO Value) or weak (60% of Define and Calculated PO Value) contributions. Parallel calculations were done for evaluating the contribution of COs, Courses and Semesters sequentially using the 'Defined CO Attainment' value (Table 5) and the 'Calculated CO Attainment' value (Table 6).

Following calculations were done for defined CO and calculated CO for each Course Outcome of a course and mapped to the respective PO.

The last row provides the average attainment of each PO for this Course. Similar calculations were done for all courses of the semester and the average attainments were tabulated as below.

The last row provides the average attainment of each PO for this Semester. Similar calculations were done for all the semesters and the average attainments were tabulated as in Table 7 and 8.

Table 3: Expected attainment of marks related to the particular level of Bloom's Taxonomy.

Level	Description	Expected Attainment (EA)	Assessment
Knowledge	Recalling or remembering	70%	Example for a Knowledge based question No. of students securing \geq EA of the maximum marks for that question No. of students attempting that question
Understanding	Understanding something that has been communicated	60%	
Application	Using a general concept to solve problems in a particular situation;	50%	
Analysis	Focus on identification of parts or analysis of relationships between parts,	40%	
Evaluation	judging with the use of definite criteria	30%	
Creativity	Creating something new by putting parts of different ideas together	20%	

Table 4: Calculated Course Outcome attainment for a Course 01.

Course 01	Direct Assessment						PT	ESE	In Direct Assessment	Total Assessment
	A	Quiz							Course Exit Form	
	1	1	2	3	4	5				
CO 1	92	89.00	-	-	-		85.53	69.93	66.35	80.56
CO 2	89		75.00	-	-	76.60	76.63	69.93	54.25	74.29
CO 3	-	-	-	93.33	-	-	72.32	69.93	45.52	70.27
CO 4	-	-	-	-	-	-	-	69.93	70.12	76.57

(A-Assignment, PT-InternalTest, ESE-End Semester Exam)

Table 5: Defined PO Attainment for each CO of Course 1.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	80.54	-	-	-	-	64.43	-	-	-	48.32	64.43
CO2	80.54	-	-	-	-	64.43	-	-	-	48.32	64.43
CO3	80.54	-	-	48.32	-	64.43	-	-	-	48.32	64.43
CO4	80.54	-	-	64.43	-	64.43	-	-	-	48.32	64.43
Course 1	80.54	0	0	56.37	0	64.43	0	0	0	48.32	64.43

Table 6: Calculated PO Attainment for each CO of Course 1.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	80.56	-	-	-	-	64.44	-	-	-	48.33	64.44
CO2	74.29	-	-	-	-	59.43	-	-	-	44.57	59.43
CO3	70.27	-	-	42.16	-	56.21	-	-	-	42.16	56.21
CO4	76.57	-	-	61.25	-	61.25	-	-	-	45.94	61.25
Course 1	75.42	0	0	51.70	0	60.33	0	0	0	45.25	60.33

Table 7: Defined PO Attainment for Semester 1.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
Course 1	80.54	-	-	56.37		64.43	-	-	-	48.32	64.43
Course 2	78.89	45.23	53.54	0	58.75	-	-		65.62	63.21	-
Course 3	79.80	-	-	60.67	73.72	56.54	68.83	54.21		54.25	56.34
Course 4	83.24	-	-	63.78	45.65	-	-	-	-	72.42	-
Semester 1	80.61	45.23	56.21	60.27	59.37	60.48	64.87	54.21	70.57	59.55	60.38

Assessing the Attainment of Program Outcomes

Calculated PO Attainments and Defined PO Attainments are derived from Calculated CO Attainment and Defined CO Attainment respectively (Table 9 and 10). Ratio of the Calculated PO Attainment to the Defined PO Attainment will give us an assessment of PO Attainment (Table 11).

IMPORTANCE OF CO-CURRICULAR AND EXTRACURRICULAR ACTIVITIES

Based on the assessment of POs as per above method it is observed that Some POs are not sufficiently mapped by the course outcomes of the curriculum hence they need to be attained through conduction of allied activities. Academic calendar of the program should be planned such that all the activities are evenly

distributed and activities conducted should be mapped to deficient POs to improve their attainment. For the development of the various facets of personality, curriculum must be supplemented with various co-curricular and extracurricular activities (allied activities). These allied activities affect all domains like cognitive, emotional, social and cultural. Co-curricular activities are more focused on cognitive aspects, thereby helping in intellectual development and allow students to blend aspects of their academic learning into personal actions. Competitiveness, excellence, creativity and enthusiasm are few of the outcomes achieved through extra-curricular activities. As per some of the research findings it was observed that the students who were assessed as good candidates had participated in the other than curriculum activities. Results of various surveys have also indicated that the amount of

Table 8: Calculated PO Attainment for Semester 1.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
Course 1	75.42	0	0	51.7	0	60.33	0	0	0	45.25	60.33
Course 2	73.73	41.20	52.14	0	51.723	0	74.2	0	61.62	62.22	0
Course 3	78.19	0	0	57.63	74.72	52.84	64.23	52.21	0	54.33	57.13
Course 4	80.19	0	54.83	61.74	43.56	0	55.54	0	71.53	71.12	0
Semester 1	76.88	41.20	53.49	57.02	56.67	56.59	64.66	52.21	66.58	58.23	58.73

Table 9: Defined PO Attainment for a Program.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
Semester 1	80.61	45.23	56.21	60.27	59.37	60.48	64.87	54.21	70.57	59.55	60.38
Semester 2	84.58	47.56	51.45	79.94	55.24	65.45	62.32	66.23	69.23	65.62	45.25
Semester 3	83.23	53.24	59.64	78.18	50.12	62.23	64.56	56.25	82.45	56.14	70.54
Semester 4	79.94	60.28	56.25	82.45	56.14	70.12	68.87	52.23	65.54	87.27	69.89
Semester 5	78.18	55.64	75.87	59.54	58	79.48	79.94	51.19	72.23	48.89	75.87
Semester 6	82.45	49.54	70.14	55.64	51.24	75.24	78.18	60.16	59.54	58	70.14
Semester 7	89.45	62.61	78.48	66.67	49.25	71.65	82.45	62.45	55.64	51.24	74.23
Semester 8	90.19	50.50	70.12	63.62	52.63	69.23	84.24	65.62	80.18	85.25	82.14
Program	83.58	53.08	64.77	68.29	54.00	69.24	73.18	58.54	69.42	64.00	68.56

Table 10: Calculated PO Attainment for a Program.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
Semester 1	76.88	40.25	51.23	56.23	54.12	51.23	61.23	52.89	65.23	54.23	56.31
Semester 2	82.35	45.54	50.21	76.25	56.23	63.23	60.23	65.23	68.75	64.23	46.23
Semester 3	79.54	51.26	55.62	75.32	49.23	60.24	61.78	55.96	81.85	54.28	69.78
Semester 4	80.25	58.23	55.13	80.25	54.14	68.21	64.59	50.89	64.23	85.67	65.23
Semester 5	74.13	52.21	74.21	57.23	55.32	76.23	79.85	50.47	70.23	46.17	74.23
Semester 6	80.26	47.26	69.25	54.15	49.13	72.13	75.23	59.55	54.23	56.32	67.25
Semester 7	85.53	60.21	76.23	65.89	47.23	70.58	80.24	61.25	52.23	50.78	70.98
Semester 8	88.25	48.15	69.25	61.78	50.27	70.96	82.35	64.98	80.09	83.23	80.37
Program	80.90	50.39	62.64	65.89	51.96	66.60	70.69	57.65	67.11	61.86	66.30

Table 11: Assessment of PO Attainment for a Program.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
Calculated	80.90	50.39	62.64	65.89	51.96	66.60	70.69	57.65	67.11	61.86	66.30
Defined	83.58	53.08	64.77	68.29	54.00	69.24	73.18	58.54	69.42	64.00	68.56
Assessment	96.76	94.93	96.71	96.49	96.22	96.19	96.60	98.48	96.67	96.66	96.70

Table 12: Extracurricular and Cocurricular activities with PO's mapped.

Sr. No	Name of Activity	Mapped to PO	Attributes Imparted
01	Poster presentation	2, 8, 11	Creativity, Presentation skill
02	Project or model competition	10, 11	Thinking ability, Innovation
03	Oral Presentation	6, 8	Knowledge, Communication
04	Debate	5, 8	Leadership skills, Team work
05	Drama	5, 7, 8	Team work, Communication

Table 13: Rubrics for Assessment of Poster presentation activity.

Levels Criteria/Attributes	Low/1	Medium/3	High/5
Relevance and depth of content to theme	Poor literature survey, inappropriate use of resources, overall content with poor relevance	Moderate literature survey, fairly good use of resources, overall content relevant	Excellent use of resources with in-depth literature survey, overall content highly relevant
Communication Skills: • Clarity • Audibility • Delivery Time Management	Poor clarity, inaudible, language errors, poor time management	Moderately clear, audible, acceptable language, reasonable time management	Extremely clear, very audible, good command over the language, perfect time management
Body Language: • Posture and confidence • Eye Contact	Not facing the audience at all, Nervous, no eye contact	Occasionally eye contact, less confident	Good eye contact and engaging the audience by delivering with confidence
Interaction with audience / defending content	Unable to answer the questions put forth by audience and judges.	Able to answer a few questions put forth by audience and judges	Satisfactorily answered maximum questions.

Table 14: Responses and calculation of average attainment b.

Sr. No.	Criteria	Low/1	Medium/3	High/5	% Attainment
1	Relevance and depth of content to theme	19	22	11	53.84
2	Communication Skills	17	20	15	58.46
3	Body Language	9	25	18	66.92
4	Interaction with audience / defending content	17	27	08	53.07
	Average attainment (b)				58.07

Table 15: Responses of participants for question 1 of feedback survey from participants.

Rating value	Number of ratings
1	9
2	11
3	13
4	9
5	10

participation in the co-curricular and extra-curricular activities was positively related to academic achievement. All these reports indicate the importance of these allied activities in addition to the curriculum;³

1. Co-curricular and Extracurricular activities develop competitive attitude amongst the students and increase efficiency in performance.
2. It also imparts the ability of innovative thinking and improves the skills of students.

3. It develops the sense of responsibility and makes the realization of duties towards family and society.
4. It imbibes the ability of organizing events and nurtures the managerial and leadership qualities.
5. It provides an opportunity to interact with people and to do self-assessment.
6. It also develops the ability to handle the critical situations and to take right decision.
7. It improves communication skill and grooms the personality
8. It aids to accomplish the personal goals and hobbies.

Types of Co-curricular and Extracurricular Activity

These activities can be classified as;

1. Study or survey related activities like model competition and field survey.
2. Physical development activities like sports.
3. Cultural development activities like drama and shows.
4. Social welfare activities like cleanliness and blood donation drive.

Mapping of Extracurricular and Co-Curricular activities to POs^{4,5}

Most of the extracurricular and Co-curricular activities develop several important characteristics in the learner. Some of the possible benefits are handling the examination stress, creative thinking, leadership skills, improved academic performance and realization of social responsibility. These activities are mapped to one or more POs and contribute to their attainment. The Table 12 describes mapping of these activities to PO and attributes imparted through them.

Illustration of Po Attainment for Co-curricular Activity⁶

Poster Presentation

Poster presentation involves preparation, display and explanation of poster based on provided theme. In this activity the participants are evaluated for qualities like knowledge about topic, teamwork, presentation skill, communication skill and creativity. This activity maps to PO 2, 8 and 11 as given in Table 12. Attainment for any extracurricular or co-curricular activity can be calculated by considering three factors;

1. Number of participants
2. Evaluation of participants by expert/judges using rubrics
3. Feedback from participants to assess knowledge gained through the activity

The calculation of PO attainment through poster presentation is exemplified below:

Consider that the poster presentation activity is conducted for the class of 60 students on the topic of Green chemistry. For this activity PO attainment will be calculated as

1. If out of 60 students, 52 participated in the activity, attainment value (a) from the participation will be, a = $54/60 \times 100 = 90\%$
2. Participants were evaluated as per rubrics given in Table 13 and 14 on the scale of 1, 3 and 5 to give attainment value b.

The formula to calculate attainment value for any criteria of rubric is as given below:

$$\text{Attainment for Criteria 1 of rubric} = \left\{ \frac{(1 \times \text{Number of students who got response 1}) + (3 \times \text{Number of students who got response 3}) + (5 \times \text{Number of students who got response 5})}{5 \times \text{Total no. of responses}} \right\} \times 100$$

The average attainment (b) is found to be 58.07

1. Feedback survey was taken from 52 participants to get the attainment value (c). They rated the feedback questionnaire on a scale of 1 – 5 (1-Poor, 2-Average, 3-Good, 4-Very Good, 5-Excellent)

The formula to calculate attainment value for any question is as given below:

$$\text{Attainment for Q1} = \left\{ \frac{(1 \times \text{Number of students who gave response 1}) + (2 \times \text{Number of students who gave response 2}) + (3 \times \text{Number of students who gave response 3}) + (4 \times \text{Number of students who gave response 4}) + (5 \times \text{Number of students who gave response 5})}{5 \times \text{Total no. of responses}} \right\} \times 100$$

Attainment value for question 1 was calculated by using responses given by 52 participants.

Attainment for Q1 = 60 %, Average attainment (c) for 10 questions of feedback survey was obtained 68.36 % (Table 15).

Total PO attainment was taken as average of attainment value a (90%), b (58.07 %) and c (68.36 %). Average attainment value for poster presentation was found to be 72.14 %. This attainment value will be added to mapping

POs (2, 8 and 11) for calculation of PO attainment of particular semester.

CONCLUSION

PO Attainment indicates the level of achievement of GAs in graduates. PO Attainment comparisons can be done at every stage from Course Outcomes at each semester till completion of program. The advantage is identification of weak contributions so that corrective actions can be taken at appropriate stages. Extracurricular and co-curricular activities have very important role in overall development of the students. It was observed that some of the POs are not satisfactorily attained by only the curriculum. The expected PO attainment value was obtained by planning activities like poster presentation in the academic calendar. The overall PO attainment value was improved after adding attainment values of these supplementary activities. Proper distribution of the activities amongst all the semesters and their mapping to all the deficient POs will help to achieve the expected PO attainment. Graduates will improve in leadership, communication, teamwork and ethics along with pharmacy knowledge and thinking abilities. This will help graduates to become universally employable and institute will successfully achieve their Program Educational objectives, Vision and Mission.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

ABBREVIATIONS

Pos: Program Outcomes; **GAs:** Graduate Attributes; **Cos:** Course Outcomes; **Los:** Learning Outcomes; **NBA:** National Board of Accreditation; **PEOs:** Program Educational Objectives; **MIS:** Management Information System.

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SUMMARY

The attainment of Program Outcomes is an indicator of the graduate's potential to demonstrate competencies and practice at appropriate levels. Programme Outcomes are derived from the Graduate Attributes (GA) specified by the National Board of Accreditation. PO attainment is calculated by considering cocurricular and extracurricular activities in addition to the curriculum specified by the affiliating University for a programme. Graduate attributes like pharmacy knowledge, thinking abilities, planning abilities, professional identity, environment and sustainability and pharmacist and society are achieved through regular curricular activities whereas several other Graduate Attributes like leadership skills, ethics and communication can be better attained through participation in extracurricular and cocurricular activities which involve such aspects. The current review describes the mapping of those activities to graduate attributes and their contribution to PO attainment.

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