Programme Outcomes Assessment by Direct Method

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Abstract— **Outcome-Based Education (OBE) is a student-centered learning method that focuses on empirically measuring student performance. OBE has become the standard of practice in the engineering education programme. The measurement of student performance is done using both direct and indirect assessment tools. The value obtained out of these tools are then transformed to a score and checked whether they meet the required attainment level of Course Outcome set for a particular Course. The scores of all the Course Outcomes collectively contribute towards the attainment of Programme Outcome. This process is recursively applied for four years until the student completes the Programme. This paper presents a direct assessment method used in measuring the Programme Outcomes (POs) via appropriate direct assessment tools. A sample assessment presented in this paper shows a process of attainment of graduate attributes stated by NBA which are in line with the Programme Outcomes of Washington Accord.**

Keywords— Direct Assessment; National Board of Accreditation(NBA) ; programmme outcomes; Course outcomes; Assessment tools.

I. INTRODUCTION

The programme curriculum of the programme should be in co-relation with programme specific criteria. The NBA proposes to adopt programme specific criteria specified by appropriate American professional associations. Each programme should cover the Courses specialized to professional content with adequate breadth and depth. The curriculum components including core engineering Courses should be focused towards the attainment of programme outcomes. Each Course in the programme curriculum would have defined a set of Course outcomes focusing towards the attainment of programme outcomes[5].

The direct assessment methods and indirect assessment methods defined to assess the performance of the students. These methods are used to evaluate the students in attaining Course outcomes in relation to programmme outcomes which in turn satisfies the Programme Educational objectives. For each Course, the Course outcomes are mapped to the Programme outcomes. Faculty assesses the attainments of Programme outcomes that are accomplished through Course outcome. The assessment reports of all the Courses must be consolidated. This report is analyzed towards the attainment of all the Programme outcomes set by the specific graduate programme which is in line with the Graduate Attributes as stated by NBA are in the spirit of Program Outcomes defined by Washington Accord.

In any engineering educational Institutions that has adopted OBE, continuous Quality Improvement (CQI) can be attained by the assessment is carried out in various ways. Each student has to undergo different assessment methods untill he gains the competency.

II. LITERATURE SURVEY

OBE has been defined clearly [2] as "Outcome-Based Education that clearly focusing and organizing an educational system around what is essential for all students to be able to do successfully at the end of their learning process. This means starting with a clear picture of what a students must be capable of doing, then organizing the curriculum, instruction, and assessment to make sure this learning ultimately happens". Outcome based education (OBE) is an educational process that is focused at achieving certain specified outcomes in terms of individual student learning[6]. Outcomes are the key substances which students should understand and be able to door the qualities they should develop [1]. The current engineering programme accreditation criteria requires an effective programme outcome (PO) assessment procedure along with well documented results, a complete description of the evaluation process that involves extensive participation of the faculty members[3].

III. IMPLEMENTATION

The department establishes the vision and mission through a continuous consultation with the stakeholders of the department like industry, management, faculty, parents, Alumni and professional bodies. The future prospect of the department and the societal requirements is also analyzed in the process of defining the vision and mission.

A programme willing to get accredited by NBA under Washington accord should define Programme Educational Objectives(PEO) that are broad Statements which describe the career and professional accomplishments of students after few years of their graduation from the programme. Programme Educational Objectives are consistent with the mission of the department.

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The programme outcomes define what students are expected to know and be able to perform by the time of graduation[4]. The Programme outcomes of an Engineering Programme need to be one-one aligned with the Graduate Attributes of NBA. Programme outcomes are defined for any given programme in a systematic procedure. The valuable views from all the stake holders of the programme such as faculty, graduating students, alumni and industry experts are collected. The knowledge on institute vision and mission statement, department vision and mission statement, programme educational objectives, graduate attributes are provided to all the stake holders of the programme.

The expectations of the stakeholder from the graduates of the Programme are collected. The draft copy of Programme outcomes are designed after a brainstorming discussion at the department level. The draft copy of Programme Outcomes are reviewed to check its accordance with the PEOs, graduate attributers. The draft copy of Programme outcomes are modified if it is deviating from attaining PEOs, graduate attributes . The final copy of Programme outcomes must be approved and circulated to the Programme stakeholders.
Course outcome of a Course define the overall conceptual knowledge and the kind of performance capabilities that a student gain upon the completion of the Course. Course Outcomes arte defined for all the Courses of the programme by the respective Course experts. These Course Outcomes should be aligned with Programme Outcomes. The overall view of the correlation among the vision mission of the department, Programme Educational Objectives, Programme Outcomes and Course Outcomes is shown in the Fig 1.

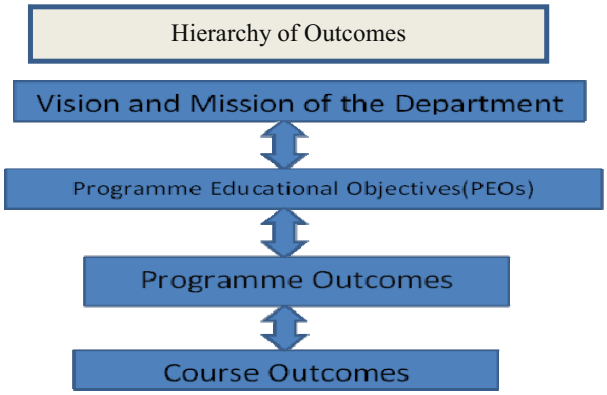

Fig 1 : Hierarchy of outcomes

A. Defining CO-PO

For the attainment of Programme outcomes, the curriculum offers a number of mandatory Courses as well as elective Courses. Every Course individually contributes towards the attainment of set of Programme Outcomes. Each Course defines a set of Course Outcomes that are mapped to the Programme Outcomes. Course Outcomes clearly relates to the Programme Outcomes and specifically define student capability, performance and knowledge upon the completion of the Course. Course Outcomes for a Course is framed in terms of measurable behaviors that a student should be expected to demonstrate as a result of learning the Course. The Course Outcomes describe what the students will be able to perform after the completion of a respective Course. A sample Course Outcome for the Course Java Programming is defined in the Fig 2. Program Outcomes, on the other hand, stipulate the knowledge, skill, or behavior that students should be able to demonstrate upon Programme completion. The Course Outcomes are defined to map few of the Programme Outcomes depending on in what way a Course may helps the students in exhibiting the knowledge, skill or behavior. A matrix is provided by the faculty to the department that presents a mapping between the Course Outcomes and Programme Outcomes.
Having successfully completed the Course Java programming, the students must be able to attain these Course Outcomes.

CO	DESCRIPTION
CO1	To understand basic syntax and Concepts of object oriented programming.
CO2	To create packages and interfaces for implementing applets and event handling techniques.
CO3	To analyze the usage of Input / Output streams. To assign priorities and resolve runtime errors with multithreading and exception handling.
CO4	To design and develop computer programs for solving real world problems.

Fig 2 : Sample Course Outcomes for the Course Java Programming

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		H		H								
CO2	H		H									
CO3	H											
CO4			H	M								

Fig 3 : Mapping of Course Outcomes to Programme Outcomes

Each of the defined Course Outcomes is mapped to appropriate Programme Outcomes. The level of attainment of this mapping is represented by the letters H, M and L corresponding to High,

Medium and Low respectively. Sample mapping for the Course Java Programming is shown in the figure 3.

B. CO-Attainment Method

The direct assessment method is carried out through different assessment tools like continuous internal evaluation which includes Theory test series, quiz and laboratory tests. The indirect method is assessed through assessment tools like Course end surveys, graduate surveys and alumni surveys.

In the direct method, the questions of different assessment tools are mapped with the Course Outcomes of the respective Course based on the Programme Outcomes criteria. Each CO attainment is the average of all the scaled marks with respect to the number of students who attempted that particular direct assessment question. Each such CO attainment is averaged to obtain the final CO attainment. The average of all the final CO attainment gives the mapped PO attainment for direct method. The performance of students is indicated as attained(Y) if his score is > 50% for a question that maps to the CO of that Course else it if not attained (N) in the table. The POs that are achievable by the completion of the Course are identified. These POs are mapped to the COs of the Course. A table is generated presenting the assessment value of the POs by consolidating all the scores of COs for a PO.

Programme Outcome	PO1	PO2	PO3	PO4	PO1	PO3	PO4	PO2	PO4
Course Outcome	CO2	CO1	CO2	CO1	CO3	CO4	CO4	CO1	CO4
Test/Quiz/Lab	T1				T2			QUIZ	LAB
QUESTION NO	Q1	Q2	Q3	Q4	Q1	Q2	Q3		
Student Register Number									
111	Y	Y	Y	Y	Y	Y	Y	Y	Y
112	Y	Y		Y	Y	Y	y	Y	Y
113	Y	N		0	y	N		Y	Y
114		Y	N	Y	Y	Y	Y	Y	Y
115	N	N		N	Y	Y	Y	Y	Y
Registered	5	5	5	5	5	5	5	5	5
Absent	0	0	1	0	0	0	0	0	0
Appeared	5	5	4	5	5	5	5	5	5
Not Attempted	1	0	2	0	0	0	1	0	0
Attempted	4	5	2	5	5	5	4	5	5
No. of Students Attained	3	3	1	3	5	4	4	5	5
Attained (%)	75	60	50	60	100	80	100	100	100

Fig 4: Sample CO-PO assessment - attainment computation

Figure 4 is a sample of CO-PO assessment for 5 students who have taken the Course Java Programming. The questions that map to a particular PO and CO using direct assessment tools like test, quiz and lab are selected. An attainment level is represented as Y if the student scores >50% else it is represented as N. The different cases considered are

1. The student may be absent for the test/quiz/lab
2. The student may not attempted

CO-PO attainment after the completion of a Course is shown in the Fig 5. For a particular PO, all COs that are mapped along with the corresponding assessment tools, and scores gained are listed. All these scores of the COs are averaged to get the final PO attainment. This process must be carried out for all the Courses of a Programme.

Programme Outcome in %	Course Outcome in%				Course outcome Attained in %	Programme outcome Attained in%
PO1	CO2	T1	**Q1**	75	75	87.5
	CO3	T2	**Q1**	100	100	
PO2	CO1	T1	**Q2**	60	80	80
	CO1	Q	**QUIZ**	100		
PO3	CO2	T1	**Q3**	80	65	65
	CO4	T2	**Q2**	50		
PO4	CO1	T1	**Q4**	100	80	90
	CO4	L	**LAB**	60		
	CO4	T2	**Q3**	100	100	

Fig 5: Final CO-PO Attainment (%)

Semester. The Courses of 4 years will in turn contribute towards the attainment of all the Programme Outcomes. Some of the Courses strongly contribute towards the attainment while some moderately. It is required to identify the improvement that has to be carried to in the next academic year to fulfill the deficiency .

For an academic year PO3 has been attained through CO2 and CO4 those have been met through the questions asked in Test, Quiz and Lab experiments attained by 80% and 50% respectively as shown in the Figure which in turns result in an attainment of 65%. To encourage the students involve in Designing, developing and implementing solutions for software based real life problems that meet the desired requirements they were assigned with the miniproject that solved some of the societal needs.

V. Conclusion

The direct method of attaining the Programme Outcomes through Course Outcomes of all the Courses that a student studies in the Programme has been discussed. This has clearly demonstrated that a student can attain the Programme Outcomes only by attaining all the Course Outcomes of the programme. The results obtained in this method can be used to identify attainment level. Any deficiencies are observed in the present assessment can be improved to achieve the required level in the next academic year. The benchmark set for attainment level may also be varied according to the complexity level of the Course. In overall a student has to exhibit the attainment of all the Programme Outcomes to achieve the competency.

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