Illustrative Rubric for Accreditation Research Methodology

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***Abstract*— The article illustrates the bidirectional impact of changes in the accreditation process and curriculum on graduate qualities. It unpacks the research methodological component of accreditation using a specialised System Control Flow for the development of demand-driven curriculum with stakeholder participation in an outcome-based educational horizon. The place of the component "Curriculum and syllabus" in outcome-based education was initially identified during the framework's model formulation. The Programme Educational Objectives (PEO) must be identified and matched to Programme results in accordance with the university/an autonomous institution's 'Mission' and 'Vision'. This Programme Outcome (PO) is directly related to Graduate Attributes (GA). Programme Educational Objectives, enlist the major attributes of a Graduate which they are supposed to possess on successful completion of the Course. However, accurate analysis of the expected outcome and actual outcome attained, largely depends on appropriate defining of 'rubrics' and identification of the attainment parameters.**

An attempt has been made in the current study, to create an effective design to determine course-need analysis for stakeholder feedback. All legislative components of traditional university curriculum design, such as the Board of Studies (BoS), have been considered. This is followed by two steps: "Teaching Learning Process" with an action plan for curriculum execution, and "Assessment and Attainment of PO's" to determine the satisfiability of PEO or the need for change under the dynamic process.

The study asserts that in addition to the designing and updating of course content from school level to post graduate or higher education level, inculcation of thought progression and process know how, for implementing the same is indispensable. The accreditation regulatory bodies need to work in this case in tandem with eminent academicians, industrialists and other stakeholders to-a. Regularly assess and accredited educational institutions and programs, b. Promote excellence in teaching, learning, and research, c. Foster self-evaluation, accountability, autonomy, and creativity, d. Conduct quality research, consulting, and training programs, e. Collaborate with stakeholders to evaluate, promote, and sustain quality.

***Keywords*—Accreditation, Curriculum, Demand driven, OBE, Program Outcome.**

ICTIEE* Track*: Research Ecosystems in Engineering Education

ICTIEE Sub-Track: Policy and Advocacy for Engineering Education Research in Institutions

I. INTRODUCTION

In curriculum design and illustrative rubric for accreditation research methodology which is the focus area of this study, accreditation plays a pivotal role (Gupta, 2016). One important aspect to be explored here is, how these two things are linked. It is always customary to create/ change the syllabus with one generalized vertical, i.e. 'Graduate attributes' and the other specific vertical happens to be the local needs / resources/ availabilities / demands; in short, local supply chain (Gupta, 2002). Change in syllabus may have long term effect. Hence, making such changes will be accompanied by accountability for a generation that are pursuing degree corresponding to the curriculum and syllabus. Hence, the community participation in the form of stakeholder satisfaction survey (PIP, TEQIP Phase II, 2009) is a must for collective responsibility and informed decision. That is why, the detailing in syllabus design is highlighted in this study.

On the other hand, accreditation happens either of the programs or of the Institutions (NAAC SSR 2020). It is primarily based on collective evaluations/ assessment of its offered programs only. By investigating this accreditation framework, one can identify the importance of syllabus contents and the steps for designing it. These steps start right from matching it to the 'graduate attributes' as prescribed by NBA, through proper CO-PO mapping, to content detailing, followed by implementing this through suitable teaching-learning processes, then appropriate evaluation/ assessment and finally GAP Analysis and bringing further changes for a continuous improvement process (NBA SSR Tier I, 2013). It is evident that, these are the verticals of which various components are evaluated in the accreditation process. Hence, foundation of this process lies in designing appropriate curriculum or syllabus and the appropriately following the remaining processes which are an important follow through. Such syllabus designing contains immense significance from accreditation viewpoint. That is how a correlation is presented here between accreditation and syllabus design. Through some crucial foundation works, it is proved here that accreditation investigation is mostly a short term / period-based issue and accreditation research methodology related framework/ methods/ techniques are yet to be widely circulated on literature.

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II. LITERATURE SURVEY

Research on accreditation methodologies are key to evaluating the effectiveness and quality of educational institutions in general and educational programs offered by them in specific. This review of literature aims to highlight the importance of a systematic approach in assessing accreditation processes and well-defined rubrics for its correct implementation. The literature review explains how rubrics are needed for standardizing assessment systems, curriculum design and to steer the entire academic practices at educational institutions.

Review of key concepts-

A. Accreditation and its' Importance

Accreditation is very important for formally recognizing any program's or institution's adherence to recognized standards of quality. It is also vital to ensure educational excellence and accountability. The aim of research methodologies in accreditation is to examine and upgrade these standards, influencing both policy-making and institutional practices (Borden, V. M. H., & Perkins, R., 2015).

B. The Role of Rubrics in Accreditation

Objectivity and Standardization: Appropriate rubrics are essential during the assessment process as rubrics help to reduce subjectivity, perceptual errors and inconsistency during the assessment process and provide a standardized approach to assessment. Rubrics also help to improve the objectivity of the accreditation procedures by defining clear criteria for assessment (Bresciani, 2006).

Continuous Improvement and Feedback: According to (Stevens & Levi, 2005), rubrics help institutions by providing feedback and clear inputs for continuous improvement. Rubrics make it easy for institutions to understand their core strengths along with areas for improvement in future. This feedback loop is extremely important for continuous improvement of quality in higher education institutions.

In accreditation research methodologies, following steps are adopted to establish the standard norms for increasing the quality standards:

Step 1: Use of case studies and comparative analysis in illustrative methodologies

Case Study Approach: To clearly demonstrate how accreditation standards could be applied by the educational institutions, use of case study approach is suggested in illustrative methodologies. The reason for this is that case studies present concrete examples of effective practices and also help to highlight the areas which neeed improvement (Borden & Perkins, 2015).

Comparative Analysis: Another approach adopted for this purpose is to do comparative studies which investigate different programs or institutions to find out the common factors which critically affect accreditation outcomes. This particular method aids in understanding the wider consequences of accreditation standards (Ewell, 2013).

Step 2: Development of Effective Rubrics in Accreditation:

By definition, rubrics are known to be effective tools that offer a structured technique to assess performance against certain specific criteria. With reference to accreditation, use of rubrics makes sure that evaluations are reliable, transparent, and aligned to the expected standards. They assist in creating benchmarks and assessing the degree to which institutions perform and fulfill the criteria laid out in these benchmarks (Stevens, D. D., & Levi, A. J.,2005).

Criteria and Standards: Impactful rubrics are created on the basis of well-defined criteria which are aligned to the accreditation standards. Many researches recommend that including all relevant stakeholders in development of rubrics increases its applicability and relevance (Gordon, 2014).

Implementation and Training: The next important stage in this case is providing appropriate training for evaluators regarding the use of rubrics and how rubrics are crucial for ensuring reliability, transparency and consistency during assessments (McDonald, 2012). Many studies assert the importance of training programs for attaining success in effective evaluation practices and procedures.

Step 3: Challenges and Criticisms

Complexity and Flexibility: Some critics maintain that at times setting of excessively rigid rubrics might negatively impact the purpose for which they are designed as they may not accommodate the unique characteristics of certain niche or varied types of institutions. Hence, some researchers highlight the importance of a bit of flexibility in rubric design for accreditation, which is highly essential for addressing the diverse contexts and settings of educational institutions at different places (Harris & Anderson, 2017).

Bias and Subjectivity: Though there are many efforts directed towards standardizing assessment procedures, a few studies maintain that there is a need to pay attention to possibilities of biases and subjectivity in rubric-based assessments. It is important to focus on finding ways to reduce these biases through better rubric design and through training of evaluators in the ongoing research (Hughes & Read, 2016).

Illustrative accreditation research methodologies with an adequate support of properly defined rubrics would definitely ensure the effectiveness and consistency of accreditation procedures (Borden, V. M. H., & Perkins, R., 2015). It is evident from the review of literature that it is important to use appropriate rubrics to standardize assessments, provide constructive feedback, and guide institutional developments. Though, challenges such as the need for flexibility and the possibility of biases remain areas of concerns for the ongoing research in this area.

C. Recent advancements in accreditation research methodologies

One of the major trends in recent times in the accreditation procedures, more specifically in the engineering education, is the shift from input-based to outcome-based assessment. Outcome-based education (OBE) highlights the importance of measurable learning outcomes which the students must attain by the completion of the programs they enrolled in. OBE focuses on aligning educational practices with real-world competencies and industry needs. The Accreditation Board for Engineering and Technology (ABET) emphasizes more and more on student outcomes to be the vital component of its accreditation process. The recent ABET criteria lays thrust on the importance of development of competencies such as ethical responsibility, problem solving and effective communication, together with technical skills in engineering disciplines (ABET, 2023). This swing from a focus on inputs (e.g., faculty

qualifications) to outputs (e.g., graduate capabilities) intends to make sure that engineering programs are directly associated to the professional requirements of engineering domains (Borrego et al., 2021). The Washington Accord highlights the importance of development of global standards in engineering education for global recognition (Thompson et al., 2021).

Thus, it is important to ensure that educational programs and the curriculum designs for them are curated as per industry needs and also taking care of specific norms of accreditation bodies which primarily aim to create graduates who are well-prepared for the workforce (Wang & Li, 2022). The educational institutions should increasingly incorporate the views of multiple stakeholders through modes such as alumni surveys, focus groups, and employer feedback to inform accreditation decisions (Lloyd et al., 2021).

III. Methodological Aspects

First of all, the outcome based educational framework presented in the following picture has to be taken into consideration.

The following points must be taken into consideration when constructing the algorithm or inquiry procedures.

- The investigation examines how changes in accreditation and curriculum affect graduate qualities.
- The article presents a methodical approach to accrediting using a system control flow to create demand-driven curriculum with stakeholder participation in an outcome-based educational horizon.
- The framework's model identifies "Curriculum and syllabus" as a component of outcome-based education.

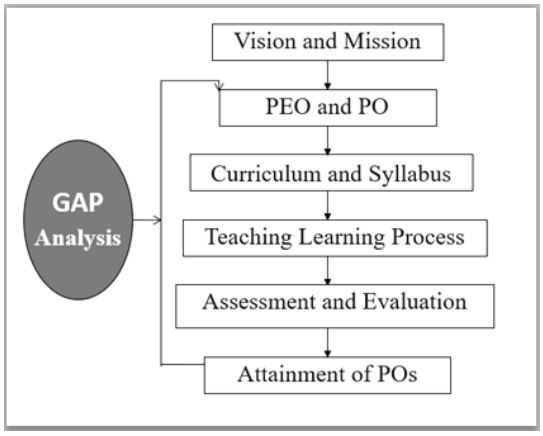

Fig. 1. Outcome Based Education framework.

Further it is essential to consider the graduate attributes as mentioned below:

- Knowledge of the subject domain
- Problem analysis
- Design and develop solutions
- Investigate complex problems
- Use of modern tools
- Professional ethics
- Group and individual work
- Project management and finance
- Lifelong learning.
- Communication

In addition, the following salient features about the process and stakeholders need to be carefully considered:

- Stakeholder feedback was used to identify course needs.
- All statutory components of traditional university curriculum design, such as the Board of Studies (BoS), have been considered.
- The process will include two steps: "Teaching Learning Process" with an action plan for curriculum execution, and "Assessment and Attainment of PO's" to assess PEO's satisfiability
- Potential changes under the Dynamic Process.

Now stakeholders' participation in the entire syllabus formulation process has been presented in the through the following diagram.

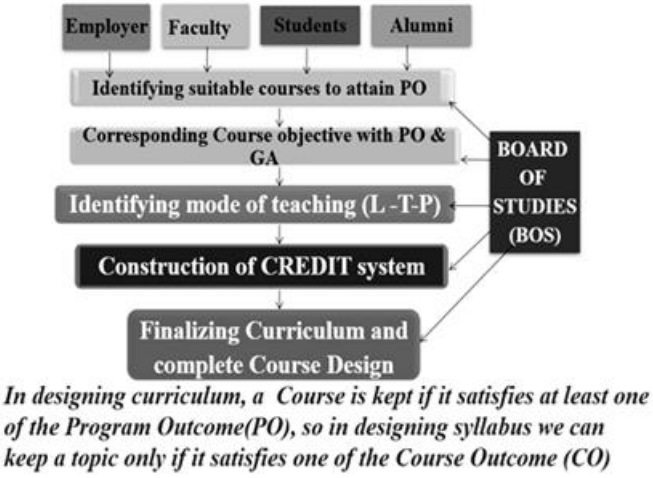

Fig. 2. Curriculum Design: Stakeholders' participation

In the above context of curriculum design, course pre-requisites played a vital role and is a complex graph as illustrated in the following figure 3

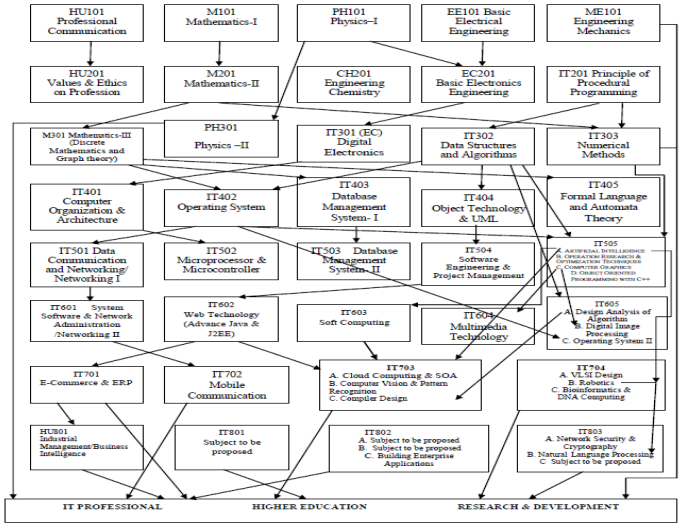

Fig. 3. Course Prerequisite

A. Algorithms

The investigation steps are as follows:

- Identify and map Programme Educational Objectives (PEO) with Program outcomes in line with the University's 'Mission' and 'Vision'.
- This Programme Outcome (PO) is directly related to Graduate Attributes (GA). The Programme Educational Objective outlines the key characteristics of a GRADUATE upon successful course completion.
- However, successful analysis of projected and actual outcomes is heavily reliant on the defining of appropriate 'Rubrics' and the identification of attainment metrics.

IV. Result and Discussion

The following are key activity requirements for verifying the results based upon the part of the illustrative dataset presented in the table 1 below:

- Periodic evaluation and accreditation of educational institutions/academic programs, etc.
- Escalate quality in learning, teaching and research through stimulation.
- Encourage self-evaluation, autonomy, accountability and innovation.
- Host quality-related research, consultancy and innovation programs
- Make alliance with other stakeholders

Apart from designing and updating course content from school to postgraduate or higher level, instilling thinking progression and procedural know-how for applying the same is critical. The national assessment and accreditation council, in collaboration with notable academicians, industrialists, web stakeholders, and scientific people, established the following vision during accessor interaction meetings (AIM):

- Regularly assess and accredit educational institutions and programs.
- Promote excellence in teaching and research.
- Foster self-evaluation, accountability, autonomy, and creativity.
- Conduct quality research, consulting, and training programs. •
- Collaborate with stakeholders to evaluate, promote, and sustain quality.

Following Table I represents the section wise GAP analysis in the accreditation process. It is illustrative and not exhaustive, though details analysis has been made based on NAAC Accreditation manual for Tier I, that is University.

TABLE I
ILLUSTRATIVE TABLE-WISE GAP ANALYSIS

3.2	**Resource Mobilization for Research**	**20 points**	3.2.1.	Research funding through non-government funding agencies such as industry, business house, IT Corporate and etc.	3	**SHEET 7**	3.2.1.	**Extramural grants for Research** Industry Chair, endowments, Chairs in the University though non-govt source of funding	5
			3.2.2.	Government agency funding for R&D projects	12		3.2.2.	Grants for research projects sponsored by the government agencies	10
			3.2.3.	Increase R&D projects from Govt. and Non-govt sponsors	5		3.2.3.	Research Project endorsement by the Govt and Non Govt funding agencies	5
3.3	**Innovation Ecosystem**	**30 points**	3.3.1.	Setting up a culture of research and innovation eco-systems – such as Incubation center, Skill center for concept and skill transfer	6	**ABSENT IN SHEET**	3.3.1.	Setting up a culture of research and innovation eco-systems – such as Incubation center, Skill center for concept and skill transfer	10
			3.3.2.	Hosting workshop seminars on Intellectual Property and Industry -Institute collaborations	7	**SHEET 8**	3.3.2.	Hosting workshop seminars on Intellectual Property and Industry -Institute collaborations	10
			3.3.3.	Awards /recognition by the students -faculty and institution as a whole	7	**SHEET 9**	3.3.3.	Awards /recognition by the students -faculty and institution as a whole	10
			3.3.4.	Number of entrepreneurship startup in last five years	10	**SHEET 10**	3.3.4.	**ABSENT**	
3.4	**Research Publications and Awards**	**100 points**	3.4.1.	Ethics code of the institution to check intellectual property theft, plagiarism etc.	1	**ABSENT IN SHEET**	3.4.1.	Ethics code of the institution to check intellectual property theft, plagiarism etc.	**5**

	3.4.2.	Performance incentives for teachers and staffs	1		3.4.2.	Performance incentives in place of who receives state, national and international recognition/awards	**5**
	3.4.3.	Published/ granted number of patents in last five years	19	**SHEET 11**	3.4.3.	Published/ granted number of patents in last five years	**10**
	3.4.4.	Number of teachers awarded Ph.D	19	**SHEET 12**	3.4.4.	Number of teachers awarded Ph.D	**10**
	3.4.5.	Number of journal papers per teacher listed in UGC website	20	**SHEET 13**	3.4.5.	Number of journal papers per teacher listed in UGC website	**15**
	3.4.6.	Teacher-wise Books and Chapter in the edited volume	15	**SHEET 14**	3.4.6.	Teacher-wise Books and Chapter in the edited volume	15

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The criterions for evaluations are well defined in the Accreditation manual covering seven Criterions for University in which first three criterions are crucial viz. Curriculum and Syllabus, Teaching Learning and Extensions, Research innovation and Extensions. For quantitative evaluation, assessment, and future improvement, the core key indicators are further subclassified into secondary indicators, which are then combined into a metric system (QnM) with specified weightage parameters (see Figure 3). As per the progression, updation of knowledge base and requirement for directional flow within the educational pyramid (pre-school→ school→ Degree college → Universities → Professional degree → Occupation), moderation of weightage needs to be initiated only within the metric system, maintaining the indictors (primary or secondary) unaltered. A case study exhibiting the key indicators with detailed analysis of "*Research, Innovations and Extension"* paradigm is shown in the following Figure 3 using survey of last two years (2018-2020).

Fig.4 shows that, there has been a considerable modification in the designing and implementation of quantitative parameters in terms of metric system from 2018 to 2020 to improve and update the education system. The secondary key indicators w.r.t. research, innovation and extension (as elucidated in Figure 3) are: 3.1) promotion of research and facilities, 3.2) resource mobilization, 3.3) innovative ecosystem, 3.4) research publication and awards, 3.5) consultancy, 3.6) extension activities and 3.7) collaboration. Furthermore, these individual secondary key indicators are analyzed further by disintegrating into metric system. On advancing from 2018 to 2020, it could be seen that a number of intrinsic metric systems have being dissolved, whereas applicability of certain Q_nM have been implemented through increased weightage. Similar analysis is regularly updated for the additional primary indicators through analogous branching pattern. Therefore, such comprehensive implementation of quantitative knowledge base with regular upgradation is expected to monitor the entire human resource of a nation towards a professional attire and educational coherency.

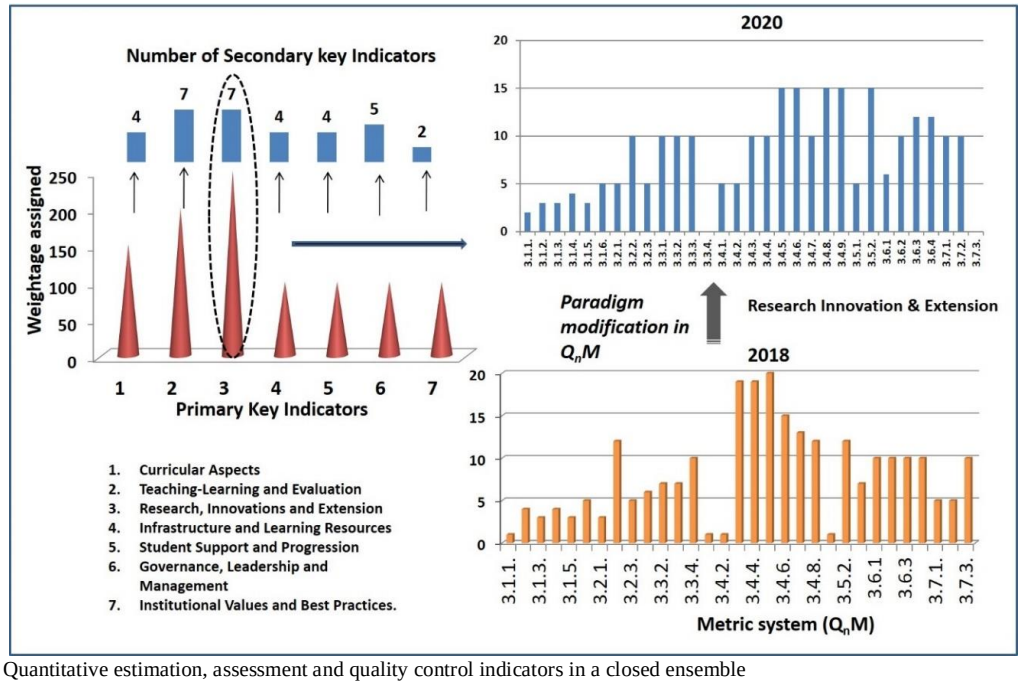
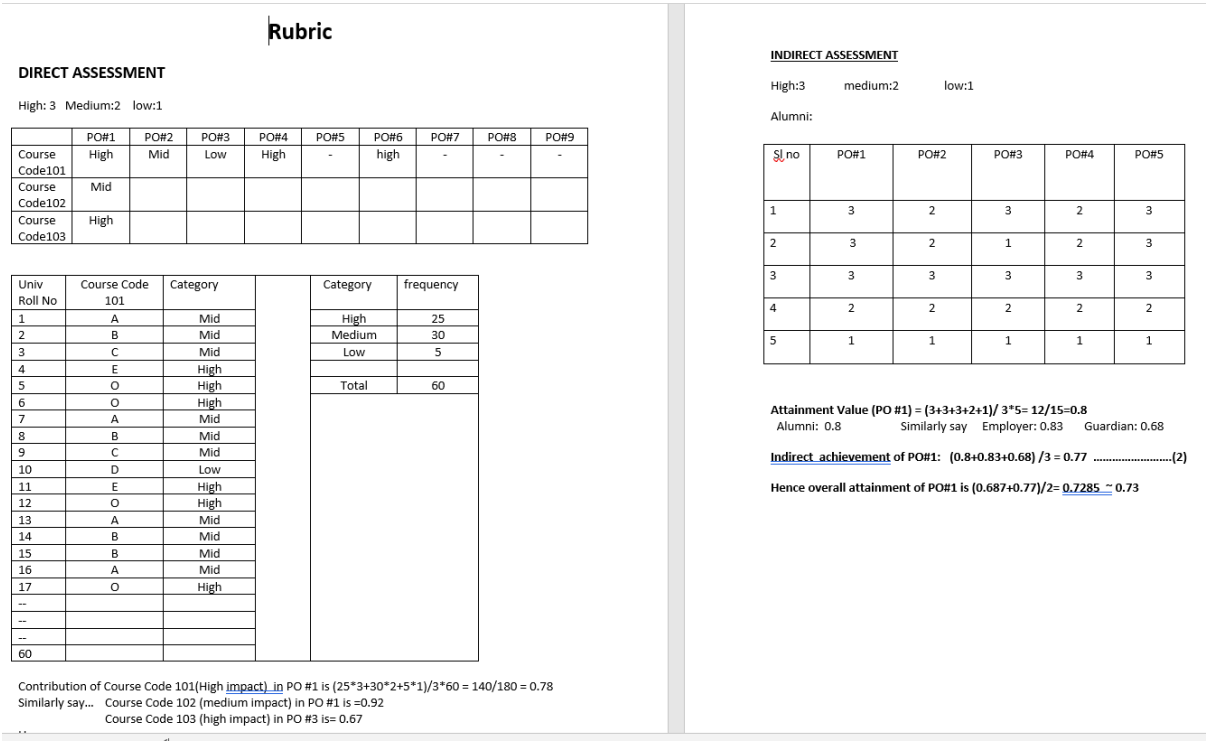


Fig. 4. Quantitative estimation, assessment and quality control indicators in a closed ensemble

An illustrative rubric is presented in the following Figure 4.



Rubric

DIRECT ASSESSMENT

High: 3 Medium:2 low:1

	PO#1	PO#2	PO#3	PO#4	PO#5	PO#6	PO#7	PO#8	PO#9
Course Code101	High	Mid	Low	High	-	high	-	-	-
Course Code102	Mid								
Course Code103	High								

Univ Roll No	Course Code 101	Category
1	A	Mid
2	B	Mid
3	C	Mid
4	E	High
5	O	High
6	O	High
7	A	Mid
8	B	Mid
9	C	Mid
10	D	Low
11	E	High
12	O	High
13	A	Mid
14	B	Mid
15	B	Mid
16	A	Mid
17	O	High
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60		

Category	frequency
High	25
Medium	30
Low	5
Total	60

Contribution of Course Code 101(High impact) in PO #1 is (25*3+30*2+5*1)/3*60 = 140/180 = 0.78
Similarly say... Course Code 102 (medium impact) in PO #1 is =0.92
Course Code 103 (high impact) in PO #3 is= 0.67

INDIRECT ASSESSMENT

High:3 medium:2 low:1

Alumni:

Sl no	PO#1	PO#2	PO#3	PO#4	PO#5
1	3	2	3	2	3
2	3	2	1	2	3
3	3	3	3	3	3
4	2	2	2	2	2
5	1	1	1	1	1

Attainment Value (PO #1) = (3+3+3+2+1)/ 3*5= 12/15=0.8
Alumni: 0.8 Similarly say Employer: 0.83 Guardian: 0.68

Indirect achievement of PO#1: (0.8+0.83+0.68) /3 = 0.77 .....(2)

Hence overall attainment of PO#1 is (0.687+0.77)/2= 0.7285 ~ 0.73

Fig. 4. Illustrative rubric

CONCLUSION

The work presents a bidirectional impact of changes in accreditation process and curriculum towards attainment of Graduate attributes. It unpacks the research methodological component of accreditation with a specialised System Control Flow for the development of demand-driven curriculum with stakeholder participation in an outcome-based educational framework.

The place of the component "Curriculum and syllabus" in outcome-based education was initially identified during the framework's model formulation. In extension to the designing and updating of course content from school to post graduate or higher level, inculcation of thought progression and process know how for implementing the same is indispensable.

Further it outlines the critical aspects of illustrative accreditation research methodologies, emphasizing the role of rubrics in achieving reliable and meaningful evaluations. The findings suggest that while rubrics enhance the accreditation process, attention to flexibility and bias mitigation is essential for ongoing improvement.

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