

COREN



**OUTLINE OF OUTCOME-BASED
EDUCATION (OBE) APPROACH**

FOR

**ENGINEERING PROGRAMMES IN
NIGERIAN UNIVERSITIES**

**COUNCIL FOR THE REGULATION OF ENGINEERING IN NIGERIA
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1.0 OUTCOME-BASED EDUCATION (OBE)

Outcome-based Education (OBE) is defined as a means of clearly focusing and organizing everything in an educational system around “*what is essential for all students to be able to do successfully at the end of their learning experiences*” (Spady, 1994). This implies starting with a clear picture of what is important for students to be able to do, then organizing curriculum, instruction, and assessment to make sure this learning ultimately happens. Such an approach presupposes that stakeholders such as COREN and others can determine what things are “*essential for all students to be able to do*”, and that it is possible to achieve these things through an appropriate organization of the education system and through appropriate inside and outside classroom practices. Therefore, OBE is a comprehensive approach toward organizing and operating a curriculum that is focused on and defined by the successful demonstrations of learning outcomes (Nakkeeran et al; 2018). It is a process that involves *assessment and evaluation* practices in education to reflect the *attainment* of expected learning outcomes and showing level of *mastery* in the programme area.

Before an education system is said to be based on outcomes, stakeholders must establish a clear framework of learning that students will be able to master successfully at the culminating point in their schooling careers (exit outcomes). Then, stakeholders must proceed to define, organize, structure, focus, and operate their activities based on those culminating outcomes. An education system based on outcomes gives top priority to ends, purposes, learning, accomplishments, and results.

Outcome-based systems exist to ensure that all students will emerge as successful learners on outcomes deemed essential to their future. This does not mean, that one uniform programme of study will be pursued at the same time in the same way. However, the same set of outcomes can be pursued via a variety of approaches and methods, and OBE teachers are continuously encouraged to explore better ways of designing and delivering instruction, especially in light of differences in student learning rates and styles (Spady, 1998, 1994).

1.1. The Purposes of OBE

OBE's two key purposes reflect its underlying “*Success for all students and staff*” philosophy. They are:

1. Ensuring that all students are equipped with the knowledge, competence, and qualities needed to be successful after they exit the educational system.
2. Structuring and operating schools so that those outcomes can be achieved and maximized for all students.

In OBE system, schools are expected to fulfill their obligation of equipping all students with the competence and qualities needed to face the challenges beyond the schoolhouse door. In addition, these purposes suggest that schools will have to change how they have been operating in order to accomplish this obligation (Spady, 1994).

1.2. Basic Assumptions of OBE System

The purposes of OBE system are based on three key assumptions or premises, and they are:

1. **All students can learn and succeed, but not all in the same time or in the same way.**
This implies the differences in students' learning rates and learning styles should not be considered as barriers to successful learning, but as factors that must be considered in designing sound instructional process.
2. **Successful learning promotes even more successful learning.**
This is based on the fact that successful learning is a product of students having a strong cognitive and psychological foundation of prior learning success. The schools can help make the cognitive and psychological foundation stronger in order to make it easier for students to continue learning successfully.
3. **Schools control the conditions that directly affect successful school learning.**
Schools are capable of changing how they operate in order to allow and encourage all students to be successful learners. It can function differently, if educators and others who work with them choose to implement needed changes (Spady, 1994).

1.3. Thrust of OBE

OBE addresses the following key questions:

1. What do we want the students to have or be able to do? (**Knowledge, Skill and Affective**).
2. How can we best help students achieve it? (**Student centered delivery**).
3. How will we know whether they (students) have achieved it? (**Assessment**).
4. How do we close the loop for further improvement? (**Evaluation through Continuous Quality Improvement (CQI)**).

Table 1: Four Essential Principles of OBE (Spady, 1994; Killen, 2000)

OBE Principles	Explanation	Application to practice
Clarity of focus	<ul style="list-style-type: none"> • Focus on what we want learners to be able to do successfully 	<ul style="list-style-type: none"> • Help learners develop competencies. • Enable predetermined significant outcomes. • Clarify short & long term learning intentions. • Focus assessments on effective learning outcomes.
Design down	<ul style="list-style-type: none"> • Begin curricula design with a clear definition of the effective learning that learners are to achieve by the end of their formal education. 	<ul style="list-style-type: none"> • Develop systematic education curricula. • Trace back from desired end-results. • Identify learning “building blocks”. • Link planning, teaching & assessment decisions to effective learning outcomes.

High expectations	<ul style="list-style-type: none"> Establish high, challenging performance standards. 	<ul style="list-style-type: none"> Engage deeply with issues about which they are learning. Expect effective learning outcomes from all learners.
Expanded opportunities	<ul style="list-style-type: none"> Students do not learn same thing in same way in same time. 	<ul style="list-style-type: none"> Provide multiple learning opportunities matching learner's needs with teaching techniques.

1.4. Traditional Education System

The traditional education system is described as teacher-centered, lecture based, curriculum-centered, and formal, in other words transmitting information from the teacher to the student. The traditional learning method provides the learner with knowledge or skills, or both, but they are not always coupled to a specific outcomes.

1.5. Paradigm Shift in the Education & Training Philosophy

The OBE paradigm shapes decision making and patterns of concrete action to the viewpoint that **WHAT** and **WHETHER** students learn successfully is more important than **WHEN** and **HOW** they learn something. From a broader perspective, this paradigm to learning entails a fundamental shift from how the system operates towards "*accomplishing results*" more important than simply "*providing services*" that does not meet the societal needs. Implicit in the OBE paradigm is the desire to have all students emerge from the system as genuinely successful learners. Therefore, OBE approach requires a shift in the curriculum process and the way in which the learner should be empowered for the achievement of outcomes.

Tables 2 and 3 summarize the major differences between traditional and Outcome Based Education system.

Table 2: Differences between Tradition Based Education and OBE (Killen, 2000)

	From (Traditional Education System)	To (Outcome based Education System)
1.	<ul style="list-style-type: none"> a teacher-centered. 	<ul style="list-style-type: none"> a student-centered.
2.	<ul style="list-style-type: none"> Teacher "owns" knowledge and conveys as much as possible. 	<ul style="list-style-type: none"> Students (trainee) to learn as much as possible.
3.	<ul style="list-style-type: none"> Teacher brings the content and the answers into the training room with him/her. 	<ul style="list-style-type: none"> Teacher act as a coach who asks questions and provides guidelines for the acquisition of knowledge.

Table 3: Differences between Content-Based Education and OBE

Content Based Learning System	Outcome Based Learning System
Passive learners	Active learners
<ul style="list-style-type: none"> Assessment process – exam & grade driven 	<ul style="list-style-type: none"> Continuous assessment
<ul style="list-style-type: none"> Rote learning 	<ul style="list-style-type: none"> Critical thinking, reasoning, reflection & action

<ul style="list-style-type: none"> • Content based/broken into subjects 	<ul style="list-style-type: none"> • Integration knowledge, learning relevant/connected real life situations
<ul style="list-style-type: none"> • Textbook/worksheet focused & teacher centered 	<ul style="list-style-type: none"> • Learner centered & educator/facilitator use group/ teamwork
<ul style="list-style-type: none"> • See syllabus as rigid & non negotiable 	<ul style="list-style-type: none"> • Learning programmes seen as guides that allow educators to be innovative & creative in designing programmes/ activities
<ul style="list-style-type: none"> • Teachers/trainers responsible for learning - motivated by personality of teacher 	<ul style="list-style-type: none"> • Learners take responsibility for their learning, learners motivated by constant feedback/ affirmation of worth
<ul style="list-style-type: none"> • Emphasizes what teacher hopes to achieve 	<ul style="list-style-type: none"> • Emphasizes outcomes – what learner becomes & understands
<ul style="list-style-type: none"> • Content placed in rigid time frames 	<ul style="list-style-type: none"> • Flexible time frames - learners work at own pace
<ul style="list-style-type: none"> • Previous knowledge & experience in learning field ignored – Each time attends whole course 	<ul style="list-style-type: none"> • Recognition of prior learning: after pre-assessment, learners credited outcomes demonstrated or transfer credits elsewhere

Table 4: Differences between Content-Based Education and OBE (By Process Perspective)

Process Step	Content-based Education	Outcome-based Education
Needs analysis	<ul style="list-style-type: none"> • A very few parties are consulted before trainers develop courses themselves. • Trainers decide on how needs are determined and expressed. 	<ul style="list-style-type: none"> • All stakeholders are consulted prior to curriculum development: employers, employees, government, special interest groups, providers and learners. • The end-product of needs analysis is reflected as unit standards.
Course design	<ul style="list-style-type: none"> • Instructional designers develop courses around the contents. • The outcomes of a course are written as objectives. 	<ul style="list-style-type: none"> • Learning programmes are designed according to the needs of the stakeholders. • Outcomes clearly indicate what the learner must be able to do in line with national standards.
Learning material	<ul style="list-style-type: none"> • The learning material is called study manuals or textbooks which is contents-driven. • The instructor determines the content. The content is mainly theoretical. 	<ul style="list-style-type: none"> • Learning material is called learning guides and is outcomes-driven. • The contents are determined by the inputs of various role-players. • The contents are practical, addressing particular skills.
Presentation	<ul style="list-style-type: none"> • The instructor presents a pre-determined lesson. • The instructor is in control of the learning event. 	<ul style="list-style-type: none"> • A facilitator presents a lesson based on the unit standard in a flexible manner. • The facilitator guides learners to achieve outcomes.

Assessment	<ul style="list-style-type: none"> Learners do assignments, write tests and examinations in order to indicate their level of competence. Limited Assessment criteria, evaluations are non-existent or vague. 	<ul style="list-style-type: none"> A variety of assessment techniques are used, for example simulations, portfolios, self-assessment, workplace assessment. Assessment and evaluations criteria are clearly defined and indicated as part of the unit standard.
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Table 5: Differences between Content-Based Education and OBE (By Learning System Characteristics Perspective) (Nakkeeran et al; 2018).

Learning System Characteristics	Content Based (Traditional/Transactional)	Outcome Based (Transformational)
Framework	<ul style="list-style-type: none"> Predefined curriculum, assessment & credentialing in place. Structures “ends”, no defined learners’ outcomes. 	<ul style="list-style-type: none"> Curriculum, instructional strategies, assessment & performance standards. Structures support outcomes, flexible & a means to define “learning ends”.
Time	<ul style="list-style-type: none"> Inflexible constraint for educator & learner schedule controls learning & success. 	<ul style="list-style-type: none"> Used alterable source – match needs of educator & learners.
Performance standard	<ul style="list-style-type: none"> Comparative & competitive approach. Linked to predetermined “curve” or quota of possible successes. 	<ul style="list-style-type: none"> Learners potentially able to receive credit for achieving performance standards. No quotas & standards pursued.
Learning assessments	<ul style="list-style-type: none"> Continuous testing & permanent grading. Mistakes on permanent record: best grades & records fast & consistent performers; slower learner never catch up. Never assess/ document what learners can ultimately do successfully 	<ul style="list-style-type: none"> Macro view learning & achievement. Mistakes inevitable steps in development, internalizing & demonstrating high level of performance capabilities. Ultimate achievement of what learners are expected to do.

1.6. Importance of OBE

The following are the importance of OBE:

1. Discourages traditional education approaches based on direct instruction of facts and standard methods.
 - a) Tradition Education provides students with a learning environment with little attention to whether or not students ever learnt the material.

- b) If students are only given grades and ranking compared to each other – students become exam oriented or CGPA driven.
- c) Graduates are not completely prepared for the workforce.
- d) Lack of emphasis on soft skills needed in jobs e.g. Communication skills, interpersonal skills, analytical skills, working attitude etc.

The input and output relationship is shown in Figures 1 and 2:

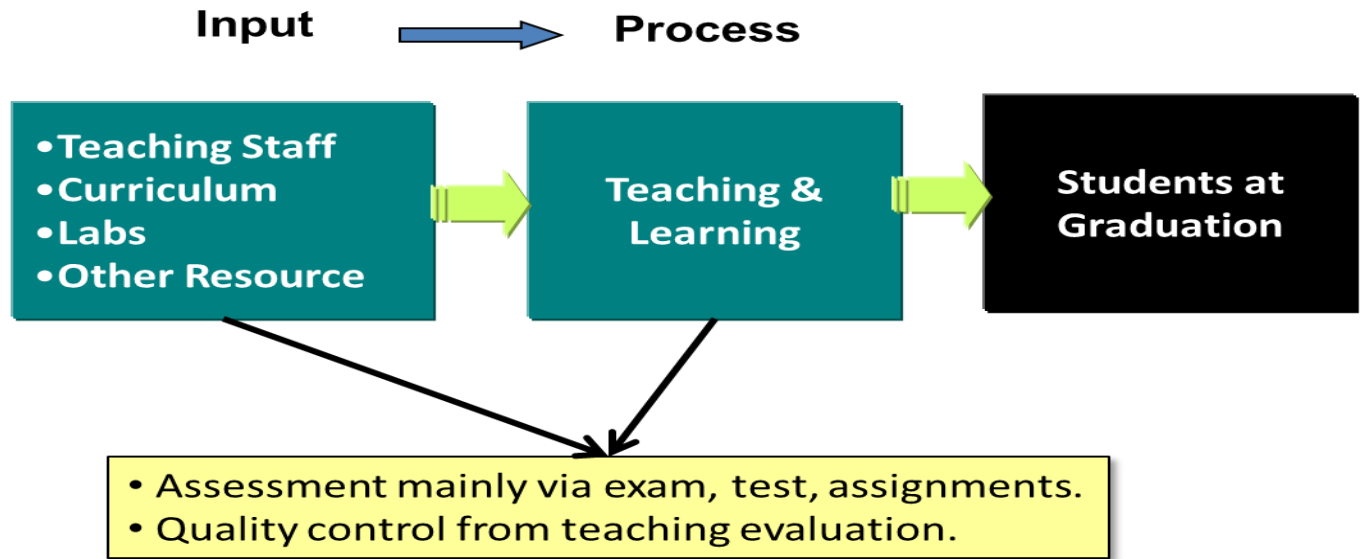


Figure 1: Traditional Education process focuses on the inputs.

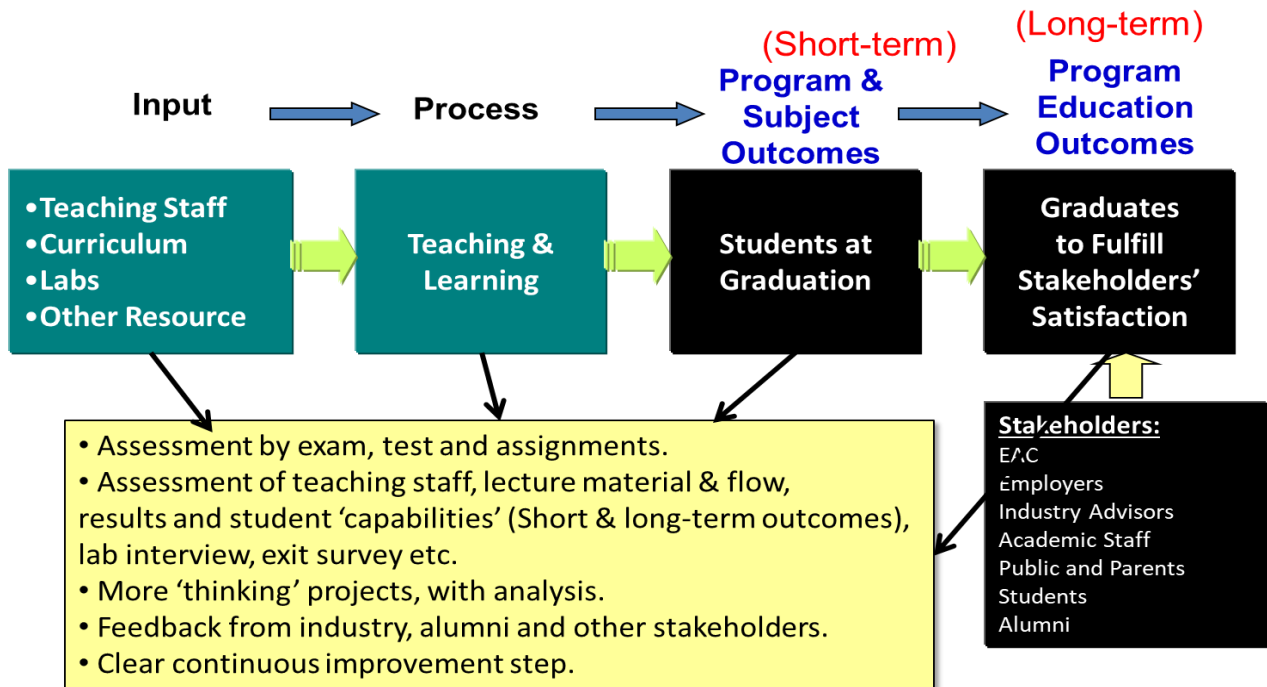




Figure 2: OBE shifts from measuring input and process to include measuring the output (Outcome)

2. OBE helps to have a more direct & rational curriculum in terms of its responsiveness to the societal and national needs.
3. OBE focuses on what students can do or the attributes they should develop after they are taught.
4. OBE requires that the students demonstrate proficiency in knowledge, skills and professional attitude.
5. It enhances graduates employability in an ever growing and competitive world.
6. Enhances universities – community and stakeholders relations.
7. OBE enhances university’s visibility and ranking.
8. OBE will become a pre-requisite for Accreditation of Engineering Programmes by COREN.
9. Degree will be well recognized in all Washington Accord Countries.
10. COREN becomes a PROVISIONAL SIGNATORY of the Washington Accord.

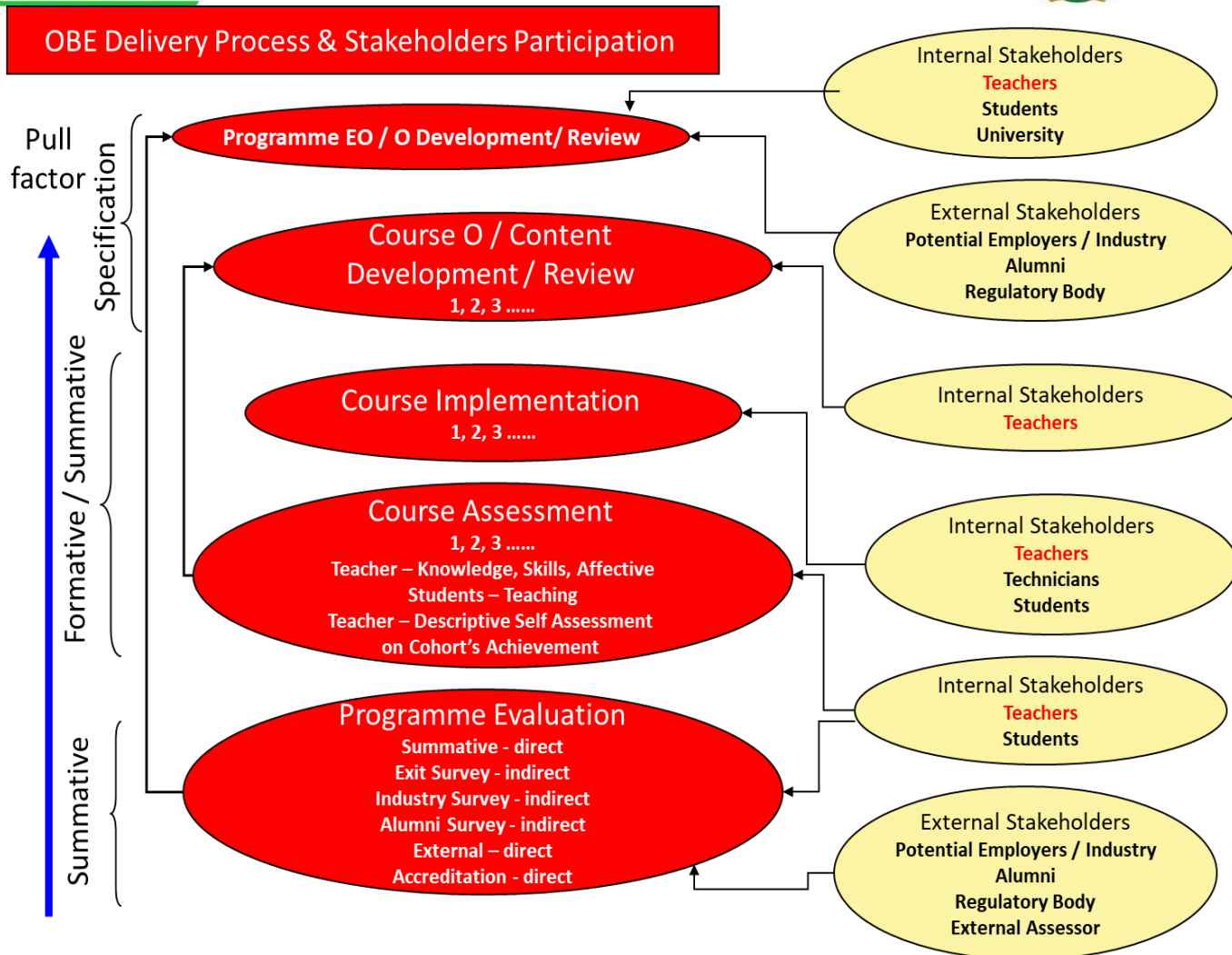


Figure 3: OBE Delivery Process and Stakeholders Participation

2.0 LEARNING OUTCOMES

2.1 What exactly are outcomes?

Outcomes are *clear learning results that we want students to demonstrate at the end of significant learning experiences*. They are *what learners can actually do with what they know and have learned*. (Tangible application of what has been learned). Outcomes are *actions and performances* that embody and reflect learner competence in using content, information, ideas, and tools successfully. They represent the ultimate result that is sought from the learning (Spady, 1994).

2.2 Domains of Learning Outcomes

Below is a detailed outline of domains associated with learning outcomes

2.2.1 Knowledge

It is about:

- a) Concepts and principles of scientific foundation
- b) Application of knowledge to solve related problems
- c) Seeking and using new knowledge to adapt to change

2.2.2. Skill Psychomotor\ Practical\ Technical

It is about:

- a) Use of systematic approach
- b) Knowledge and application of practice
- c) Proficiency in intervention activities and use of resources
- d) Use of evidence – based approaches
- e) Practice, Practice and Practice

2.2.3 Social Responsiveness & Responsibility

It is about:

- a) Capacity building for sustainable livelihood.
- b) Respecting cultural differences and finding opportunities in building skills.
- c) Managing work processes to produce an overall positive impact on society.

2.2.4 Professionalism, Values, Attitudes, Ethics

It is about:

- a) Commitment to set of shared values, excellence, altruism, responsibility, compassion, accountability, honesty and integrity, respect, cultural diversity and beliefs.
- b) Commitment to scientific methods.
- c) Autonomy in setting and enforcing these values.
- d) Responsibilities to self- regulate and uphold values for clients, profession & society.

2.2.5. Critical Thinking & Scientific Approach

It is about:

- a) Ability to use scientific methods, solve problems and evaluate outcomes for clients.
- b) Seeking and using of appropriate information to solve problems.
- c) Ability to undertake self- assessment and be self-directed.
- d) Ability to use evidence.

2.2.6. Communications & Team Skills

It is about:

- a) Ability to communicate information verbally and in writing
- b) Effective presentation skills
- c) Being an effective member and leader of a team
- d) Effective interpersonal relationship

2.2.7. Management & Entrepreneurial Skills

It is about:

- a) Building faith and commitment (Creating a vision).
- b) Creating a NICHE (making own BRAND and being own CEO).
- c) Planning and Following through (GOALS & OUTCOMES).
- d) Utilizing their strengths and what they do best.
- e) Partnering and building relationships and being resource to others.
- f) Understanding their value propositions (Negotiations Skills).
- g) Engaging risks and reality simultaneously.
- h) Being proficient in English.

2.2.8. Lifelong Learning & Information Management

It is about:

- a) Creating “educational interest”
- b) Creating learning opportunities
- c) Effective self-directed learning (SDL) activities
- d) Use of IT
- e) Retrieving relevant information and using it to benefit client/service

The Washington, Sydney and Dublin Accords are for Engineers, Engineering Technologists and Engineering Technicians respectively. These accords allow engineering practitioners to have mobility around the world.

Table 6: Engineering Depth of Knowledge Required @ IEA

Washington Accord (WA) Complex Problems	Sydney Accord (SA) Broadly Defined Problems	Dublin Accord (DA) Well defined Problems
<ul style="list-style-type: none"> • Requires in-depth knowledge that allows a fundamentals-based first principles analytical approach. 	<ul style="list-style-type: none"> • Requires knowledge of principles and applied procedures or methodologies. 	<ul style="list-style-type: none"> • Can be solved using limited theoretical knowledge, but normally requires extensive practical knowledge.

2.3. Engineering Graduate Attributes

(See Annex A of COREN Accreditation Manual for Engineering Programmes in Nigeria Universities, 2019).

1. Annex A-1: Examples of Engineering Content of some Programmes
2. Annex A-2: Knowledge Attribute Profile
3. Annex A-3: Definition of Complex Problem Solving

Table 7: Knowledge of Engineering Sciences

Differentiation Characteristic	WA	SA	DA
Breadth and depth of education and type of knowledge, both Theoretical and Practical	Apply knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the <u>solution of complex engineering problems</u> (<i>conceptualization of engineering models</i>)	Apply knowledge of mathematics, science, engineering fundamentals and an engineering specialization to defined and applied engineering procedures, processes, systems or methodologies.	Apply knowledge of mathematics, science, engineering fundamentals and an engineering specialization to wide practical procedures and practices.

Table 8: Problem Analysis

Differentiation Characteristic	WA	SA	DA
Complexity of analysis	Identify, formulate, research literature and analyse (solve) complex engineering problems reaching substantiated conclusions <i>using first principles</i> of mathematics, <u>natural sciences</u> and engineering sciences.	Identify, formulate, research literature and solve broadly-defined engineering problems reaching substantiated conclusions <i>using analytical tools</i> appropriate to their discipline or area of specialisation.	Identify and solve well-defined engineering problems reaching substantiated conclusions <i>using codified methods</i> of analysis specific to their field of activity.

Table 9: Design/Development of Solutions

Differentiation Characteristic	WA	SA	DA
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<p>Breadth and uniqueness of engineering problems i.e. the extent to which problems are original and to which solutions have previously been identified or codified</p>	<p>Design solutions for <i>complex engineering problems</i> and <i>design systems, components or processes</i> that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.</p>	<p>Design solutions for <i>broadly- defined engineering technology problems</i> and <i>contribute to the design of systems, components or processes</i> to meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.</p>	<p>Design solutions for <i>well-defined technical problems</i> and <i>assist with the design of systems, components or processes</i> to meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.</p>
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Table 10: Investigation

Differentiation Characteristic	WA	SA	DA
<p>Breadth and depth of investigation and experimentation</p>	<p>Conduct investigations (of) <i>into complex problems using research based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of information</i> to provide valid conclusions.</p>	<p>Conduct investigations of <i>broadly-defined problems</i>; locate, search and select relevant data from codes, data bases and literature, design and conduct experiments to provide valid conclusions.</p>	<p>Conduct investigations of <i>well-defined problems</i>; locate and search relevant codes and catalogues, conduct standard tests and measurements.</p>

Table 11: Modern Tool Usage

Differentiating Characteristic: Level of Understanding of the Appropriateness of the Tool

Differentiation Characteristic	WA	SA	DA
	Create, select, and apply appropriate techniques, resources, and modern engineering <u>and IT</u> tools, including prediction and modelling, to complex engineering activities , with an understanding of the limitations	Select and apply appropriate techniques, resources, and modern engineering tools, including prediction and modelling, to broadly defined engineering activities , with an understanding of the limitations	Apply appropriate techniques, resources, and modern engineering tools to well-defined engineering activities , with an awareness of the limitations

Table 12: The Engineer and Society

Differentiation Characteristic	WA	SA	DA
Level of knowledge and responsibility	<u>Apply reasoning informed by contextual knowledge to assess</u> (Demonstrate understanding of the societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice .)	Demonstrate understanding of the societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to engineering technology practice.	Demonstrate knowledge of the societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to engineering technician practice.

Table 13: Environment and Sustainability

Differentiation Characteristic	WA	SA	DA
No differentiation in this characteristic	Understand the impact of <u>professional</u> engineering solutions in a societal <u>and environmental</u> contexts and demonstrate knowledge of and need for sustainable development.	Understand the impact of engineering solutions in a societal context and demonstrate knowledge of and need for sustainable development.	Understand the impact of engineering solutions in a societal context and demonstrate knowledge of and need for sustainable development.

Table 14: Ethics: Differentiating Characteristic:

Differentiation Characteristic	WA	SA	DA
	<u>Apply ethical principles</u> and commit to professional ethics and responsibilities, and norms of engineering practises; Understand and commit to professional ethics, responsibilities, and norms of engineering practises	Understand and commit to professional ethics, responsibilities, and norms of engineering practice	Understand and commit to professional ethics, responsibilities, and norms of engineering practice

Table 15: Communication

Differentiation Characteristic	WA	SA	DA
Level of communication according to type of activities performed	Communicate effectively on <i>complex engineering activities</i> with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation , make effective presentations, and give and receive clear instructions.	Communicate effectively on <i>broadly-defined engineering activities</i> with the engineering community and with society at large, by being able to comprehend and write effective reports and design documentation , make effective presentations, and give and receive clear instructions	Communicate effectively on <i>well-defined engineering activities</i> with the engineering community and with society at large, by being able to comprehend the work of others, document their own work, and give and receive clear instructions

Table 16: Individual and Teamwork

Differentiation Characteristic	WA	SA	DA
Role in and diversity of team	Function effectively as an individual, and as a member or leader in diverse teams and in multi-disciplinary settings .	Function effectively as an individual, and as a member or leader in diverse technical teams.	Function effectively as an individual, and as a member in diverse technical teams.

Table 17: Lifelong Learning

Differentiation Characteristic	WA	SA	DA
No differentiation in this characteristic	Recognize the need for, and have the <u>preparation and ability to engage in independent and life-long learning.in the broadest context of technological change</u>	Recognize the need for, and have the ability to engage in independent and life-long learning.	Recognize the need for, and have the ability to engage in independent and life-long learning.

Table 18: Project Management and Finance

Differentiation Characteristic	WA	SA	DA
Level of management required for differing types of activity	Demonstrate knowledge and understanding of <u>engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments</u> (business practices, such as risk and change management, and <u>understand their limitations</u>).	Demonstrate an awareness and understanding of management and business practices, such as risk and change management, and understand their limitations.	Demonstrate an awareness of management and business practices, such as risk and change management.

3.0. REVISED BLOOM'S TAXONOMY

Benjamin Bloom led a group of educational psychologists in formulating a theory which is based upon the idea, that there are levels of actions that describe and classify observable knowledge, skills, attitudes, behaviours and abilities. It became a taxonomy with three overlapping domains: the cognitive, psychomotor, and affective. The Cognitive domain deals with the intellectual development (Bloom, 1956), the Affective domain deals with the development of feelings and attitudes (Krathwohl, 1964); and the Psychomotor domain deals with motor skills development (Simpson, 1972). However, in the 1990s, Lorin Anderson (former student of Bloom) revisited the taxonomy and made a number of changes that reflects a more active form of thinking and is perhaps more accurate. The changes indicate explicitly what the student must do in order to demonstrate learning (Pohl, 2000). The revised bloom's taxonomy is shown in Figure 4 and Tables 19, 20 and 21 describe the category order and sample behavioral verbs of the three domains.

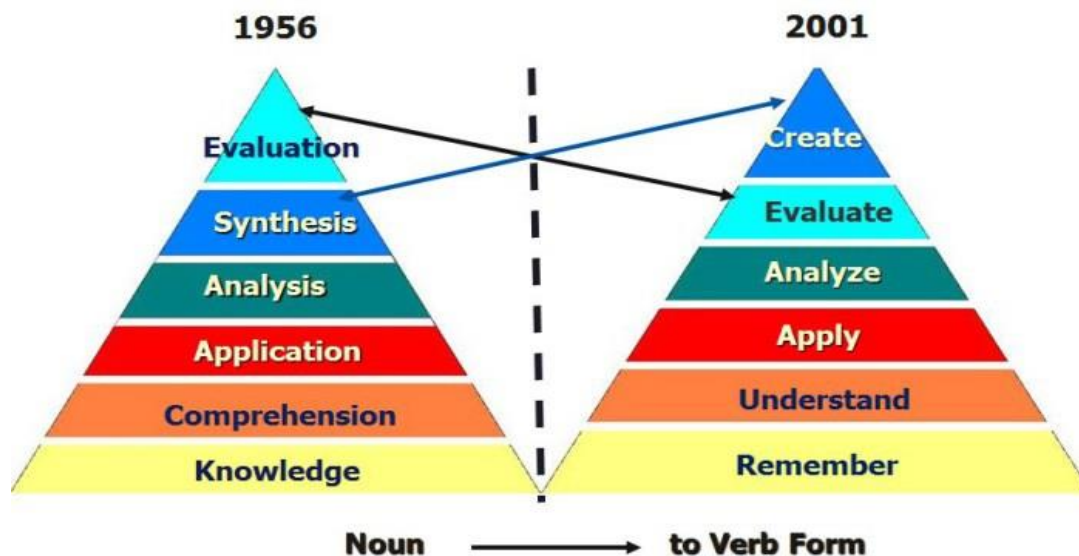


Figure 4: Revised Bloom's Taxonomy (Wilson, 2001)

Table 19: Cognitive Domain

Category Order	Sample Behavioral Verbs
Remembering: Can the students recall or remember the information?	Defines, describes, identifies, knows, labels, lists, matches, names, outlines, recalls, recognizes, reproduces, selects, states,...
Understanding: can the student explain ideas or concept?	Comprehends, converts, defends, distinguishes, estimates, explains, extends, generalizes, gives an example, infers, interprets, paraphrases, predicts, rewrites, summarizes, translates,...
Applying: can the student use the information in a new way?	Applies, changes, computes, constructs, demonstrates, discovers, manipulates, modifies, operates, predicts, prepares, produces, relates, shows, solves, uses,...
Analyzing: Can the student distinguish between the different parts?	Analyzes, breaks down, compares, contrasts, diagrams, deconstructs, differentiates, discriminates, distinguishes, identifies, illustrates, infers, outlines, relates, selects, separates,...
Evaluating: can the student justify a stand or a decision?	Appraises, compares, concludes, contrasts, criticizes, critiques, defends, describes, discriminates, evaluates, explains, interprets, justifies, relates, summarizes, supports,...
Creating: can the student create new product or point of view?	Categorizes, combines, compiles, composes, creates, devises, designs, explains, generates, modifies, organizes, plans, rearranges, reconstructs, relates, reorganizes, revises, rewrites, summarizes, tells, writes,...

Table 20: Psychomotor Domain

Category Order	Sample Behavioral Verbs
Perception (awareness): The ability to use sensory cues to guide motor activity.	Chooses, describes, detects, differentiates, distinguishes, identifies, isolates, relates, selects,...
Set: Readiness to act. It includes mental, physical, and emotional sets.	Begins, displays, explains, moves, proceeds, reacts, shows, states, volunteers, ...
Guided Response: The early stages in learning a complex skill that includes imitation and trial and error.	Copies, traces, follows, react, reproduce, responds,...
Mechanism (basic proficiency): This is the intermediate stage in learning a complex skill.	Assembles, calibrates, constructs, dismantles, displays, fastens, fixes, grinds, heats, manipulates, measures, mends, mixes, organizes, sketches, ...
Complex Overt Response (Expert): The skillful performance of motor acts that involve complex movement patterns.	Assembles, builds, calibrates, constructs, dismantles, displays, fastens, fixes, grinds, heats, manipulates, measures, mends, mixes, organizes, sketches,...

	Note: The Key Words are the same as Mechanism, but will have adverbs or adjectives that indicate that the performance is quicker, better, more accurate, etc.
Adaptation: Skills are well developed and the individual can modify movement patterns to fit special requirements.	Adapts, alters, changes, rearranges, reorganizes, revises, varies,...
Origination: Creating new movement patterns to fit a particular situation or specific problem.	Arranges, builds, combines, composes, constructs, creates, designs, initiate, makes, originates,...

Table 21: Affective Domain

Categories Order	Sample Behavioral Verbs
Receiving Phenomena: Awareness, willingness to hear, selected attention.	Asks, chooses, describes, follows, gives, holds, identifies, locates, names, points to, selects, sits, erects, replies, uses, ...
Responding to Phenomena: Active participation on the part of the learners.	Answers, assists, aids, complies, conforms, discusses, greets, helps, labels, performs, practices, presents, reads, recites, reports, selects, tells, writes., ...
Valuing: The worth or value a person attaches to a particular object, phenomenon, or behaviour.	Completes, demonstrates, differentiates, explains, follows, forms, initiates, invites, joins, justifies, proposes, reads, reports, selects, shares, studies, works,...
Organization: Organizes values into priorities by contrasting different values, resolving conflicts between them, and creating a unique value system.	Adheres, alters, arranges, combines, compares, completes, defends, explains, formulates, generalizes, identifies, integrates, modifies, orders, organizes, prepares, relates, synthesizes,...
Internalizing values (characterization): Has a value system that controls their behavior.	Acts, discriminates, displays, influences, listens, modifies, performs, practices, proposes, qualifies, questions, revises, serves, solves, verifies, ...

4.0. OBE CURRICULA

4.1. Developing OBE Curricula

Under OBE, curriculum design includes:

1. Determining future conditions
2. Deriving exit outcomes
3. Developing performance indicators
4. Determining instructional strategies
5. Delivering instruction
6. Documenting results
7. Determining advancement

4.2. Characteristics of OBE Curricula

The following are characteristics of the OBE Curricula:

1. It has programme educational objectives, programme outcomes, course learning outcomes, performance indicators and target for student achievements.
2. It is objective and outcome-driven, where every stated objective and outcomes can be assessed and evaluated.
3. It is centered on the needs of the students and the stakeholders.
4. Every learning outcome is intentional and therefore the outcomes must be assessed using suitable performance indicators.
5. Programme objectives address the graduates' attainment within 3-5 years after their graduation.
6. Programme outcomes, which consist of abilities to be attained by students before they graduate, are formulated based on the programme objectives.
7. Programme outcomes address Knowledge, Skills and Attitudes to be attained by students. As shown in Chart below, education programme are based on two categories. i.e. education and training. Education addresses cognitive, while the training addresses the psychomotor and affective domains.

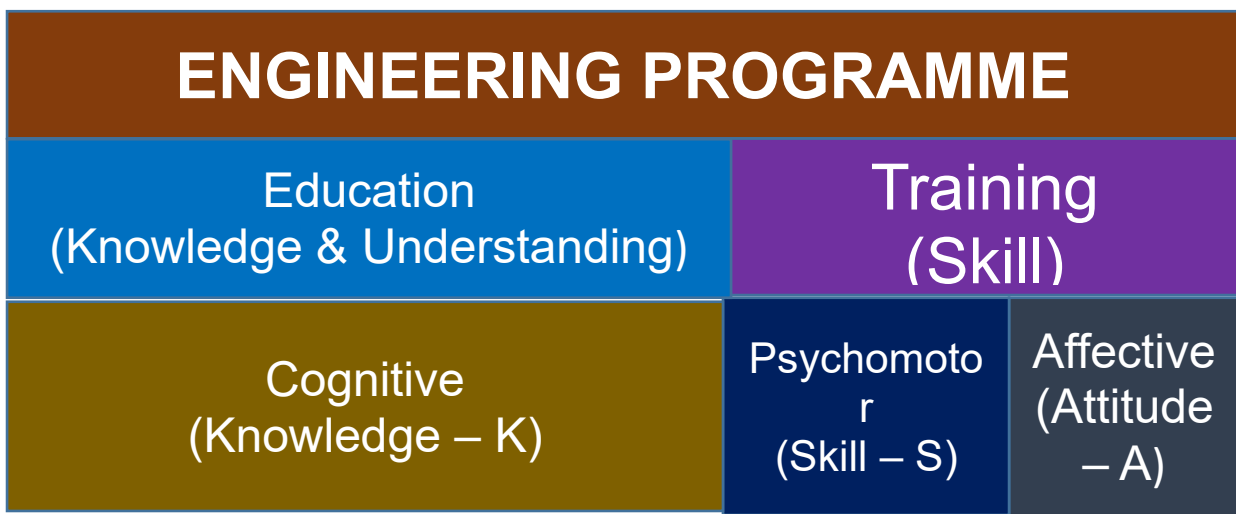


Figure 5: Domains of Engineering Programme

8. Course learning outcomes must satisfy the stated programme outcomes. There is no need for ANY (individual) CLOs to address all programme outcomes.
9. Learning methods have to be integrated to include different delivery methods.

4.3. Models of Curricula Content

In association with Blooms taxonomy, different models of curricula content can be developed as shown in Figure 6:

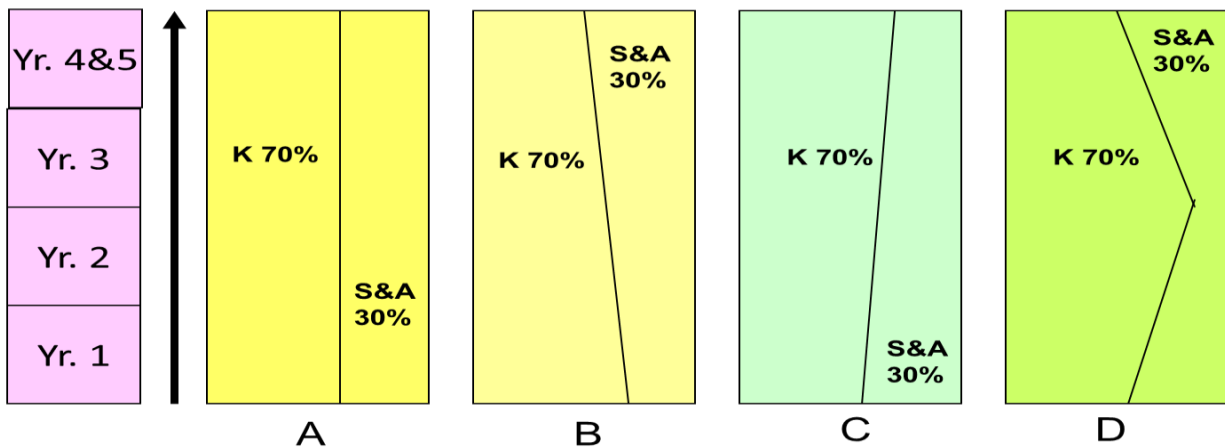


Figure 6: Distribution of Knowledge, Skills And Attitude Elements Throughout the 5 Years Programme

4.4. Programme Educational Objectives

Programme Educational Objectives are what is expected in term of Knowledge, skill and altitudes of students few years (say 3- 5 years) of graduation (What the programme prepares graduates in their career and professional accomplishments?).

4.5. Characteristics of Good Programme Educational Objectives (PEO) Statements

1. Each addresses one or more needs of one or more stakeholders
2. Consistent with the mission and vision of the institution
3. Expectation by stakeholders addressed
4. Number of statements should be limited and manageable
5. Should not be simply restatement of outcomes
6. Forward looking and challenging
7. Should be stated such that a graduate can demonstrate in their career or professional life after graduation (long term in nature)
8. Distinctive/unique features/having own niche
9. **S**pecific, **M**easurable, **A**chievable, **R**ealistic, and having a **T**ime frame (**SMART**)
10. Clear, concise, consistent and reachable

11. Has clear link to the POs & curriculum design

12. Reviewed, revised & updated continually

13. Published and Publicised

4.6. Programme Outcomes

Programme Outcomes are what the graduates are expected to know and able to perform or attain by the time of graduation (skills, knowledge and behaviour/attitude). There must be a clear linkage between Programme Educational Objectives and Programme Outcomes.

4.7. Characteristics of Good Programme Outcomes Statements

1. Each describes an area of knowledge and / or skills that a person can possess.
2. Should be stated such that a student can demonstrate before or by the time of graduation.
3. Should be supportive / responsive of / to one or more programme education objectives (must be linked to the programme education objectives).
4. Do not have to include measures or performance expectations.
5. Responsive to objectives.
6. Take advantage of the “unique” character of the Institution.
7. Should meet the specific programme criteria.
8. Package: Knowledge, skills, attitude, etc
9. Cover the domain in the nation qualifications framework or accreditation requirements for programmes.

Programme Outcomes

(See Section 3.2.2 of COREN Accreditation manual, 2019 for Programme Outcomes).

4.8. Course Learning Outcomes

4.8.1 Course Content Development

This covers:

1. Content – typical topics in the subject matters
2. Subject Topics – teaching plan
3. Course Learning Outcomes – group of learning (topic) outcomes
4. CLO-PO matrix – is it satisfactory?

Considerations of:

1. Depth – e.g. Bloom’s Taxonomy
2. Delivery and assessment
3. Students’ time and competencies covered

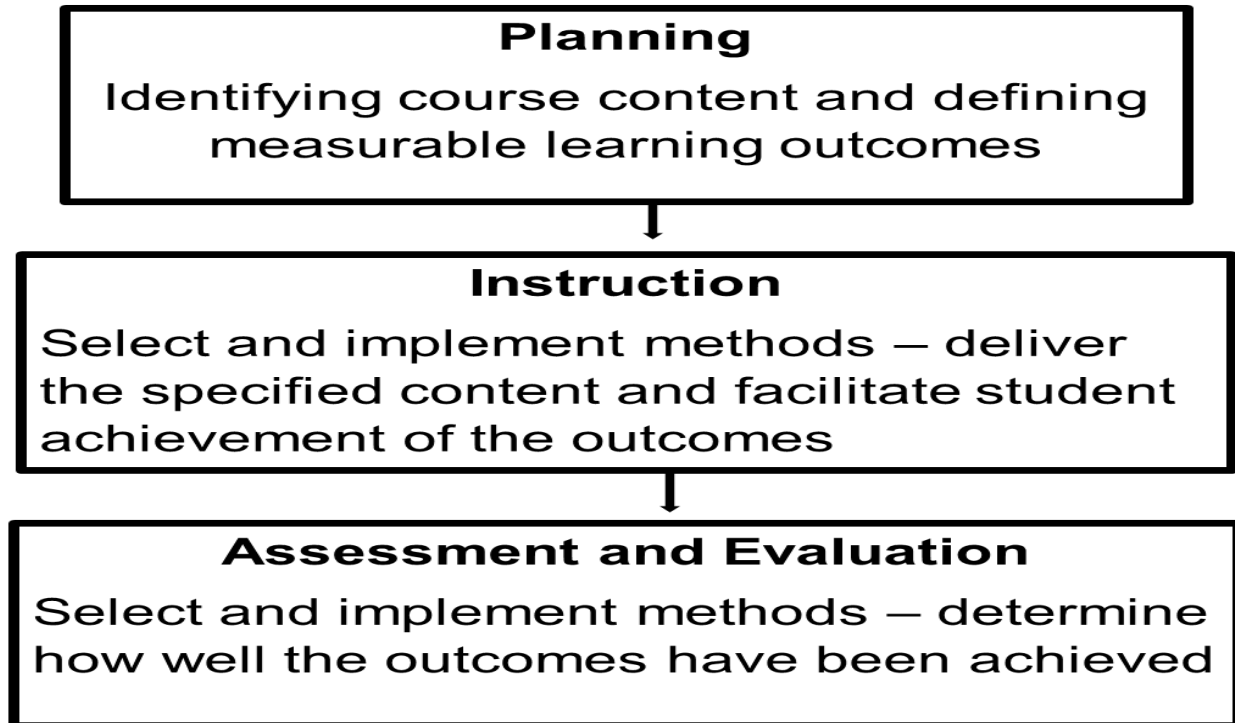


Figure 7: Creating a Course Content

4.8.1. Why are Course Learning Outcomes (CLOs) important?

CLOs are essential because they:

1. Define the *type and depth of learning* students are expected to achieve
2. Provide an objective *benchmark* for formative, summative, and prior learning **assessment**
3. Clearly *communicate expectations* to learners
4. Clearly communicate *graduates' skills* to the stakeholders
5. Define *coherent units* of learning that can be further subdivided or modularized for classroom or for other delivery modes.
6. **Guide and organize** the instructor and the learner.
7. Enable better planning of instruction and since they are end points, they ensure lecturers know where they are going.
8. If the student knows where the lecturer is going, they can direct their attention and effort to a goal point.
9. Improve performance assessment through between test constructions.
10. Provide clearly defined parameters for evaluation.

4.8.2. Essential Components of a Course Learning Outcome:

1. **Action verb (V):** Describe behavioural action
Ability to:
 - *describe* the principles used in designing X.
 - *evaluate* the strengths and weakness of ...
- i. Well-written verbs must be *observables* i.e. : (SMART)
Specific, Measurable, Achievable, Realistic and Time bound.
- ii. Try to avoid using these *not observable*: appreciate, aware, familiar, know, learn, understand.
2. **Condition (C) :** Context under which the behaviour is to happen
 - i. *describe* the principles used in designing X (V).
 - ii. *orally describe* the principles used in designing X. (V&C)
 - iii. *design* a beam. (V)
 - iv. *design* a beam *using Microsoft Excel design template* . (V&C)
3. **Standard (S) :** Criteria of acceptable level of performance
 - i. *describe* the principles used in designing X.(V)
 - ii. *orally describe* the principles used in designing X. (V&C)
 - iii. *orally describe* the **five** principles used in designing X. (V&C&S)
 - iv. *design* a beam. (V)
 - v. *design* a beam *using Microsoft Excel design template* . (V&C)
 - vi. *design* a beam *using Microsoft Excel design template* based on *BS 5950:Part 1*. (V&C&S)

4.8.3. Guidelines for formulating CLOs

1. Uses action verbs that specify definite , observable behaviours
2. Uses simple language
3. Describes student rather than teacher behaviour
4. Describes an outcome rather than a learning process
5. Focuses on end-of-instruction behaviour rather than subject matter coverage
6. Can be assessed by one or more indicator (methods)
7. Is realistic, attainable and clearly link to a goal
8. Is not simple when complexity is needed
9. Is clear to the people outside the discipline
10. Is validated by departmental colleagues

4.8.4. Example of Best practices in formulating learning outcomes by adding a condition and standard

Poor

- Students should be able to design research.

Better

- Students should be able to independently design and carry out experimental and correlational research.

Best

- Students should be able to independently design and carry out experimental and correlational research that yields valid results (Bergen, 2000).

Table 22: Mapping Course Outcomes against Programme Outcomes

Course Outcomes	Programme Outcomes									
	1	2	3	4	5	6	7	8	9	10
1st Semester Courses Course 1 Outcome 1 Outcome 2 Outcome 2 ↓ Course 2 ↓ Course 3	1.2 or 3 1.2 or 3 1.2 or 3	1.2 or 3 1.2 or 3 1.2 or 3	1.2 or 3 1.2 or 3 1.2 or 3	1.2 or 3 1.2 or 3 1.2 or 3	1.2 or 3 1.2 or 3 1.2 or 3	1.2 or 3 1.2 or 3 1.2 or 3	1.2 or 3 1.2 or 3 1.2 or 3	1.2 or 3 1.2 or 3 1.2 or 3	1.2 or 3 1.2 or 3 1.2 or 3	1.2 or 3 1.2 or 3 1.2 or 3
2nd Semester Courses										
3rd Semester Courses										
4th Semester Courses										
5th Semester Courses										
6th Semester Courses										
7th Semester Courses										
8th Semester Courses										
9th Semester Courses										
10th Semester Courses										

4.8.5. Linking topics to Programme Educational Objectives

1. Topics lead to learning objectives.
2. Group/individual learning objectives lead to course outcome.
3. Course outcomes must relate to programme outcomes.
4. Programme outcomes address the programme objectives.

5.0 ASSESSMENT

In education, assessment is the process of gathering, interpreting, recording and using information about learners' responses to an educational task (Harlen et al; 1992). It is the process that identify, collect, use and prepare data for evaluation of achievement of programme outcomes or educational objectives.

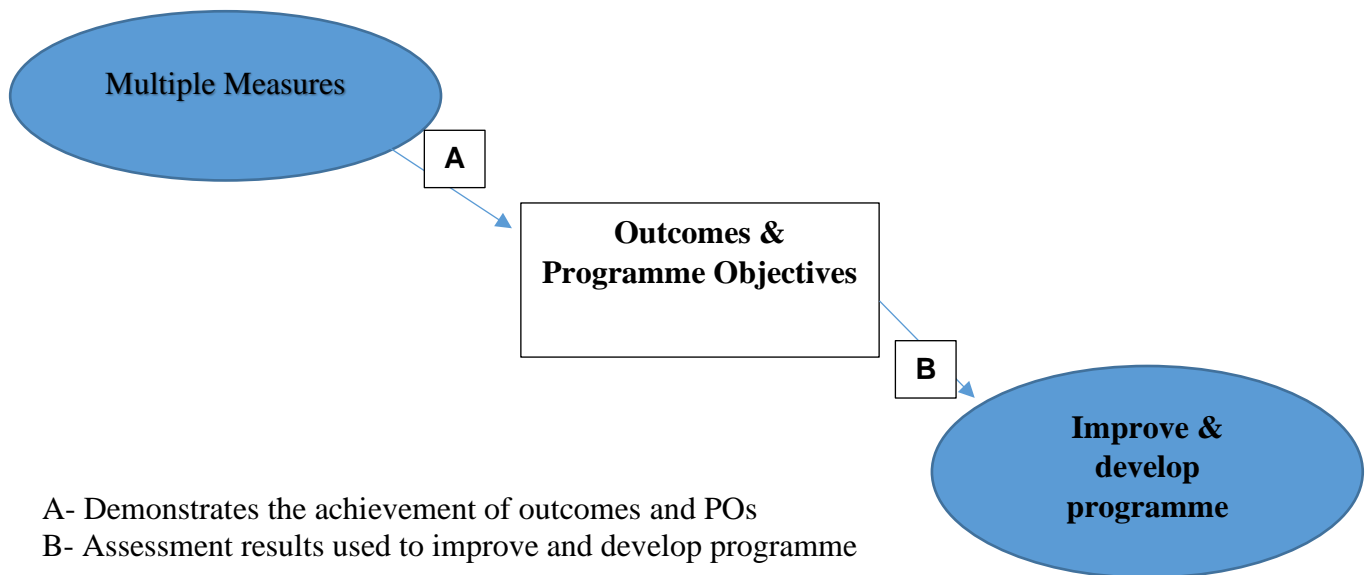


Figure 8: Assessment of Outcomes and Programme Objectives

In other words, Assessment is:

1. The formative or/and summative determination for a specific purpose of the student's competence in demonstrating a specific outcome.
2. The processes that identify, collect, use, and prepare data that can be used to evaluate achievement.

Rightfully, Assessment is done because it:

1. Helps to distinguish between teaching and learning.
2. Informs what students know.
3. Provides feedback to improve teaching\ learning process

5.1. Formative Assessment

1. Believe all students are **teachable**.
2. Assessment is carried out frequently and is planned at the same time as teaching.
3. Collecting information according to preset criteria to supply feedback on how learning can be improved.
4. Teaching\ learning materials are structured in manageable components and assessed.

5. Feedback to students on their learning achievements for students to improve their learning; allows lecturer/ student to recognize the “gap” in learning.
6. Adjust teaching/learning activities taking into account of feedback.

5.2. Summative Assessment

1. Judging the worth according to preset criteria of the student’s demonstration of outcome attainment competence.
2. Used to assess a learner’s achievement under examination conditions, using tests and exams only and report only the marks.
3. The test and examination is a final measure of the student’s ability\ competence.
4. Tests are comprehensive and thorough.
5. Reliability is essential as they are used numerically to classify students and compare them to each other.

5.3. Analog of Formative Assessment and Summative Assessment

When the cook tastes the soup, that’s formative assessment.

When the customer tastes the soup, that’s the summative assessment.

5.4. Formative Assessment and Summative Assessment

Formative assessment takes place during the course of teaching and is used essentially to feed back into the teaching and learning process.

In other words, “The soup can still be improved!”

Summative assessment is the “sum” of teaching\learning assuming a finality status and happens at the end of a course. By analogy. The student is past help, just like the soup!

5.5. Assessment Tools

1. Exit surveys, Exit interviews (P)
2. Alumni surveys and interviews (P)
3. Employer surveys and interviews (P)
4. Job offers, starting salaries (relative to national benchmark) (P)
5. Admission to graduate schools (P)
6. Performance in group and internship assignments and in PBL situation (P, C)
7. Assignments, report and tests in capstone design course (P, C)

5.6 Standardized Tests (P, C)

1. Student surveys, individual and focus group interviews (P, C)
2. Peer-evaluations, self-evaluations (P, C)
3. Student portfolios (P,C)
4. Behavioral observation (P,C)
5. Written tests linked to learning objectives (C)
6. Written project reports (C)

7. Oral presentation, live or videotape (C)
8. Research proposals, student-formulated problems (C)
9. Classrooms assessment Techniques (C)

Note: P- Programme C- Course

5.7. Assessment Tools for Programme Outcomes (PO)

1. Course – based Embedded Assessment
2. Student Course Satisfaction Survey
3. Cumulative GPA (CGPA) index for Each Course
4. Senior Design Projects- Index of Excellence
5. Programme Accreditation
6. Academic Review- External Examiner
7. Graduate Employment Statistics

5.8. Formative Assessment Tools for Course Learning Outcomes (CLO)

A. Lecturer centered

1. Written tests linked to course outcomes
2. Oral presentation and assessment
3. Student surveys, individual and focus group interviews
4. Written projects reports
5. Assignments, and reports in capstone design subject

B. Student centered

6. Demonstration and simulation
7. Student portfolios
8. Peer-evaluations and self-evaluations
9. Behavioral observation

5.9. Summative Assessment Tools for Course Learning Outcomes (CLO)

1. Written examination and tests linked to course outcomes
2. Oral presentation and assessment
3. Student surveys, individual and focus group interviews
4. Written projects reports
5. Demonstration
6. Employer survey

Table 23: Functions of Formative and Summative Assessment Techniques

Formative assessment (to improve for)	Summative assessment (to prove for)
<ul style="list-style-type: none">• Lecturers to ensure that learning has taken place	<ul style="list-style-type: none">• Employers for job selection
<ul style="list-style-type: none">• Lecturers to improve methods of instruction	<ul style="list-style-type: none">• Curriculum developers for curriculum reviews
<ul style="list-style-type: none">• Students to gain an idea of their success	<ul style="list-style-type: none">• Validation/ accreditation bodies for award of grades and diplomas

<ul style="list-style-type: none"> • Monitors progress in learning by students 	<ul style="list-style-type: none"> • Students for selecting courses of higher study
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5.10. The Fundamental of Effective Assessment

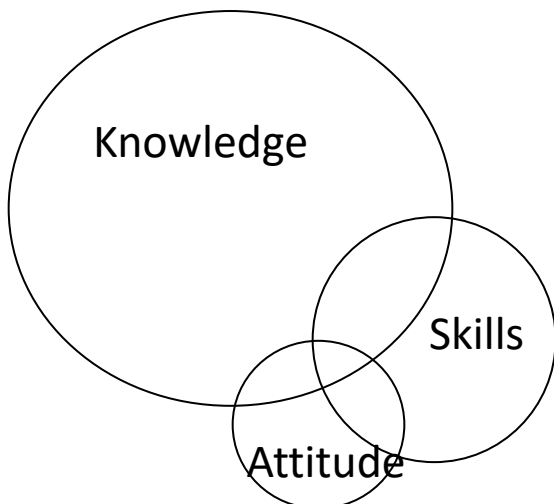
1. Assessment should help students to learn
2. Assessment must be consistent with the objective of the course and what is taught and learnt
3. Variety in types of assessment allows a range of different outcomes to be assessed. It also keeps students interested
4. Students need to understand clearly what is expected of them in assessed tasks
5. Criteria for assessment should be detailed, transparent, and justifiable
6. Students need specific and timely feedback on their work- not just be informed of a grade/mark
7. Too much assessment is necessary and may be counter-productive
8. Assessment should be undertaken with an awareness that an assessor may be called upon to justify a student’s result
9. Group assessment needs to be carefully planned and structured
10. When planning and wording assignment or questions, it is vital to mentally check their appropriateness to all students in the class, whatever their cultural differences
11. Systematic analysis of students’ performance on assessed tasks can help identify areas of the curriculum which improvement

5.11. Course Coverage & Assessment

When assessing, an instructor must consciously assess and evaluate the applicable elements (Knowledge, Skills, and Attitude). An activity may be used to examine all the three elements

Model A

Competencies



Model B

Competencies

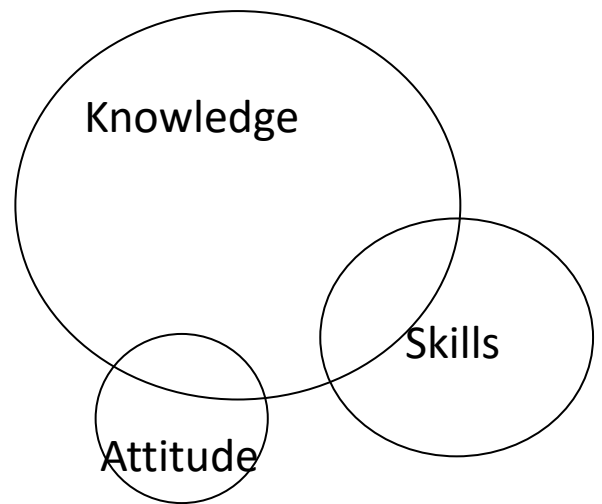




Figure 9: Different Models of Course Coverage

Table 24: Course Summary Sheet



**Course Assessment
Department of Civil Engineering**

Semester: _____
 Course No./Name: _____
 Instructor: _____

1. Attach Course Syllabus.

2. Review of previous year's assessment (Review comments in the previous year's discipline group review, and recommendations in previous course assessments. Have the recommended changes been made? If not, why not? Are the recommended changes still valid?)

Comments:

3. Instructor's assessment of program-related outcomes (Based on course evaluations, student comments, and instructor observation, rate the degree of achievement of applicable outcomes listed in the syllabus. Rating scale: 4 = quite successful; 3 = adequately successful; 2 = partially successful; 1 = not successful.)

Outcome	Rating*	recommendations/comments
1.1		
1.2		
1.3		
1.4		
1.5		
2.1		
2.2		
2.3		
2.4		
3.1		
3.2		
3.3		
3.4		
4.1		
4.2		

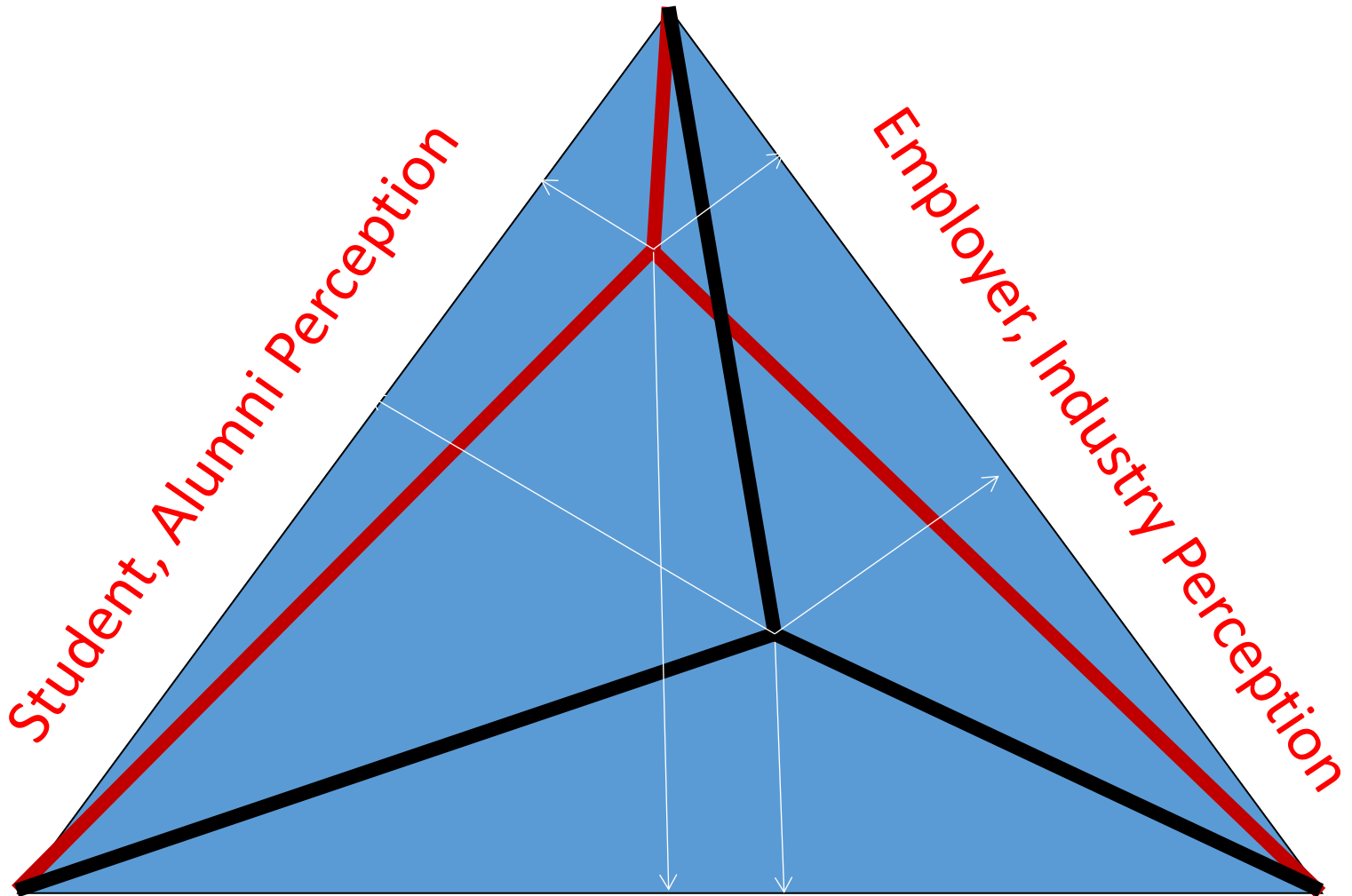
* Identify and rate outcomes applicable to this course.

4. Review of assessment mechanisms (Do the exam questions and key assignments provide the intended means of assessment? Do the course evaluation questions provide the intended means of assessment?)

Comments:

6.0 EVALUATION

Processes for interpretation of data and evidence from assessment practices that determine the program outcomes are achieved or result in actions to improve programme.



University Assessment & Evaluation

Figure 10: Assessment & Evaluation Triangulation

6.1. Presenting Assessment Result

1. A staff member can represent the data graphically
2. How many students meet the expected standard of “meet criterion”, the number that are making progress can be determined
3. Staff should think through how data are going to be used before developing a rubric.

6.2. Rubric

Rubric is a working guide for students and teachers, usually handed out before the assignment begins in order to get students to think about the criteria on which their work will be judged. It is an authentic assessment tool, designed to simulate real life activity where students are engaged in solving real-life problems.

6.2.1. Rubrics - What are they good for?

1. It is a *set of categories* developed from the *performance criteria* that define and describe progression toward meeting important components of work being completed, critiqued, or assessed.
2. Each category contains a gradation of *levels of completion or competence* with a *score assigned* to each level and a *description of what performance criteria need to be met* to attain the score at each level.

6.2.2. 3 common features of rubrics

1. Focus on measuring a stated objective (performance, behaviour, or quality).
2. Use a range to rate performance.
3. Contain specific performance characteristics arranged in levels indicating the degree to which a standard has been met (Pickett and Dodge).

Table 25: Rubric (Adopted from G. Rogers)

	4 - Exceeds Criteria	3 - Meets Criteria	2 - Progressing to Criteria	1 - Below Expectations
Content	Provides ample supporting detail to support solution/argument	Provides adequate supporting detail to support solution/argument.	Some details but may include extraneous or loosely related material.	Inconsistent or few details that may interfere with the meaning of the text.
Organization	Organizational pattern is logical & conveys completeness & wholeness.	Organizational pattern is logical & conveys completeness & wholeness with few lapses.	Little completeness & wholeness, though organization attempted.	Little evidence of organization or any sense of wholeness & completeness.
Style	Uses effective language; makes engaging, appropriate word choices for audience & purpose.	Uses effective language & appropriate word choices for intended audience & purpose.	Limited & predictable vocabulary, perhaps not appropriate for intended audience & purpose.	Limited or inappropriate vocabulary for the intended audience & purpose.
	Consistently follows the rules of standard English.	Generally follows the rules for standard English.	Generally does not follow the rules of standard English.	Does not follow the rules of standard English.

6.2.3. Types of Rubrics

1. An analytic rubric provides specific information about student performance on any given performance criterion.
2. A holistic rubric is broad in nature and provides information about the overall, general status of student performance (instead of creating separate categories for each criterion, the criteria are grouped under each level of the rubric).
3. A generic rubric can be used across a variety of activities where students get an opportunity to demonstrate their performance on an outcome (e.g., communication skills, where it could be used in a writing course or a design course).
4. A task-specific rubric is developed with a specific task in mind (focused and would not be appropriate to use outside of the task for which it was designed).

6.2.4. Rubric Scoring

The use of rubrics when scoring student work provides the programme with valuable information about *how students are progressing* and also *points to specific areas* where students need *to improve*.

1. For example, when a staff member is grading a student's paper, he/she can also *score the paper for the student's writing skills using the rubric* provided.
2. The *scores obtained* by each student can be *aggregated* and used *for programme assessment*.

6.2.5. Levels

1. How many points (levels) should a rubric have?
2. It is important to consider both the nature of the performance (complexity) and the purpose of the scoring.
3. If the rubric aims to describe student performance at a single point in time, then three to five points are recommended.
4. If student performance is to be tracked over time and the focus is on developmental growth, then more points are needed.
5. Remember, the more points on the scale, the more difficult it is to get multiple raters to agree on a specific rating.

6.2.6. Effective Rubrics

1. For programme assessment, the most effective rubrics (generally speaking) are analytic, generic, and the use of a three- to five-point scale.
2. Good websites designed to help with the development of rubrics.
<http://edtech.kennesaw.edu/intech/rubrics.htm>.
3. Many examples of rubrics on the web, but just because they are on the web, it doesn't mean they're good examples. Proceed with caution.

6.2.7. Advantages of Rubrics

1. Rubrics *improve student performance* by clearly showing the student how their work will be evaluated and *what is expected*.
2. Rubrics help students become *better judges* of the quality of their own work.
3. Rubrics allow *assessment* to be more *objective and consistent*.

4. Rubrics force the teacher to *clarify his/her criteria* in specific terms.
5. Rubrics *reduce* the amount of time teachers spend *evaluating* student work.
6. Rubrics promote student *awareness* about the *criteria to use in assessing* peer performance.
7. Rubrics provide useful *feedback* to the teacher regarding the *effectiveness of the instruction*.
8. Rubrics provide students with more *informative feedback* about their *strengths and areas in need of improvement*.
9. Rubrics accommodate heterogeneous classes by *offering a range of quality levels*.
10. Rubrics are *easy to use* and easy to *explain*.

Table 26: Assessment Strategy and Instruments for Industrial Project and Course Development.

Implementation strategy	Assessment strategy	Data source/ Assessment instrument
Industrial project: Improve student competence in communication, teamwork, and project management	Exams, interview, survey, observe, assess, skill level, monitor, development of skills	Reports, interviews schedule, survey, observation records, grades of exams and projects, exit skill checklist
Design course: Address industry needs	Assessment criteria from literature, by industry, and lecturers	List of assessment criteria, observation reports, interview, students evaluation, exams, exit skill checklist

6.3. Performance Criteria/ Indicators

6.3.1. Good Teamwork

Students are able to demonstrate:

1. Positive contribution to the team project (minutes of meeting)
2. Well prepared and participate in discussion (observation)
3. Volunteer to take responsibility
4. Prompt and sufficient attendance
5. Aplomb and decorum

7.0 CONTINUOUS QUALITY IMPROVEMENT (CQI)

Occur when assessment and evaluation processes provide critical information to academic staff and administrators on the effectiveness of the design, delivery, and direction of an educational programme. It is an improvements based on feedback from evaluations that will close the system loop and this process continue year after year.

Continual Quality Improvement (CQI) is not only limited to *exam system, library system, administrative system and human resources or finance division*. But it includes a feedback system on *curriculum review, facility improvement, delivery and attainment of outcomes*.

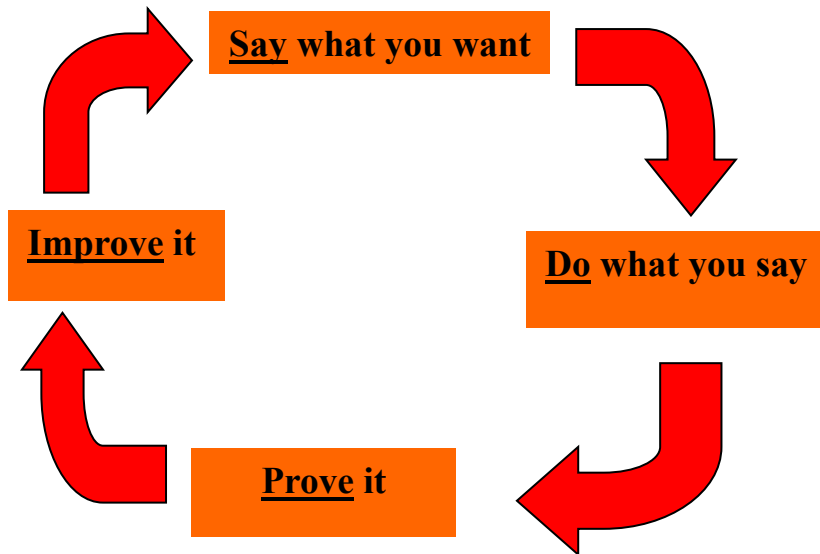


Figure 11: Continuous Quality Improvement (Gift, 2012)

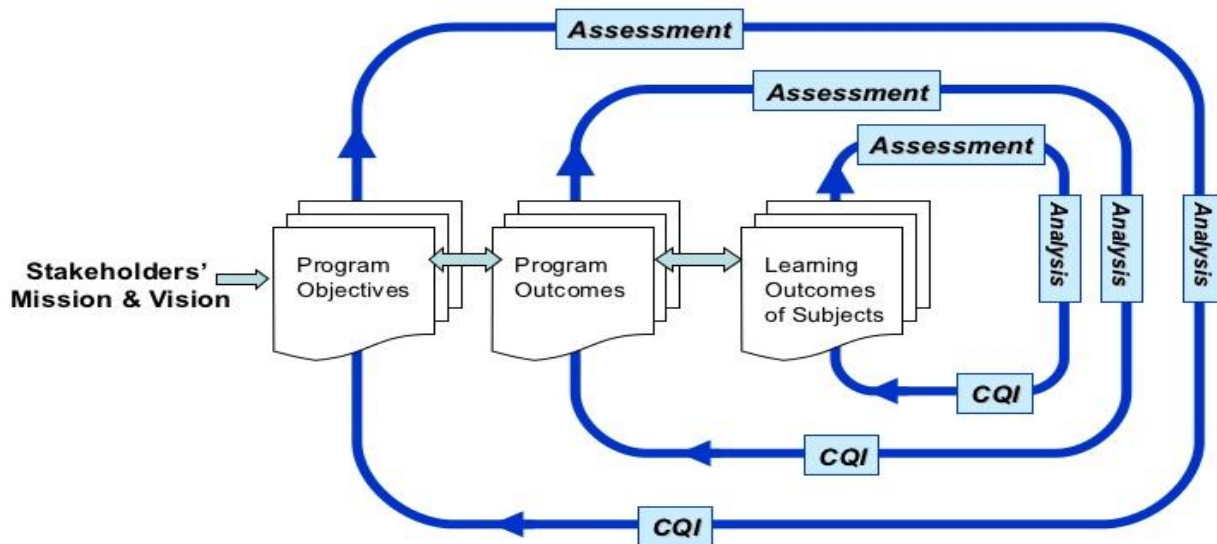


Figure 12: Outcomes Based Education Process Cycle

7.1. Assessment & Continual Quality Improvement (CQI)

The following are the various steps involve in using assessment result for continual quality improvement of a programme.

1. Determine assessment process at the beginning of a course
2. Grades to determine the course outcomes
3. Develop questions aimed at course outcomes
4. Set expectations for a satisfactory level of student’s performance for each question (% correct) and overall level of group performance
5. Implement assessment
6. Conduct evaluation
7. Analyze data for possible changes in the course curriculum
8. Report data to Department committee
9. Make plan for CQI

Figure 13: CQI of Course Outcomes and Programme Outcomes

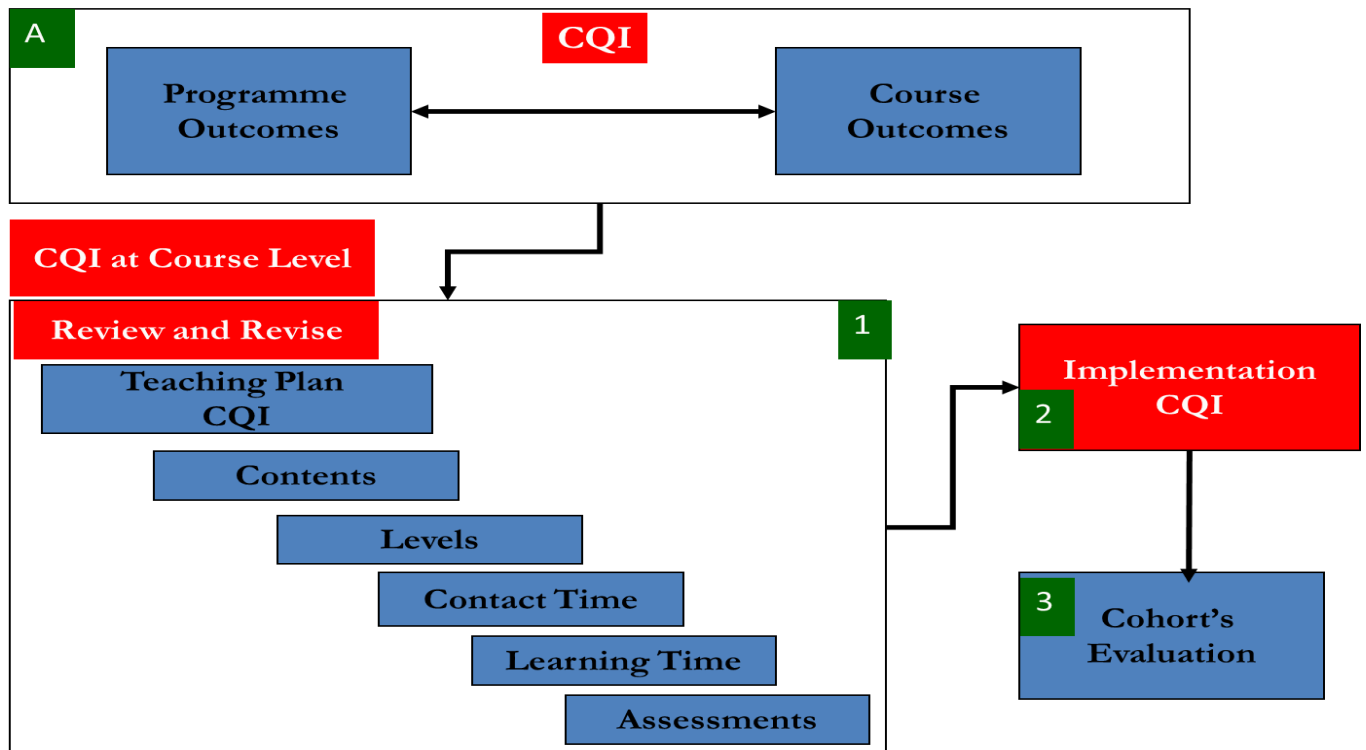
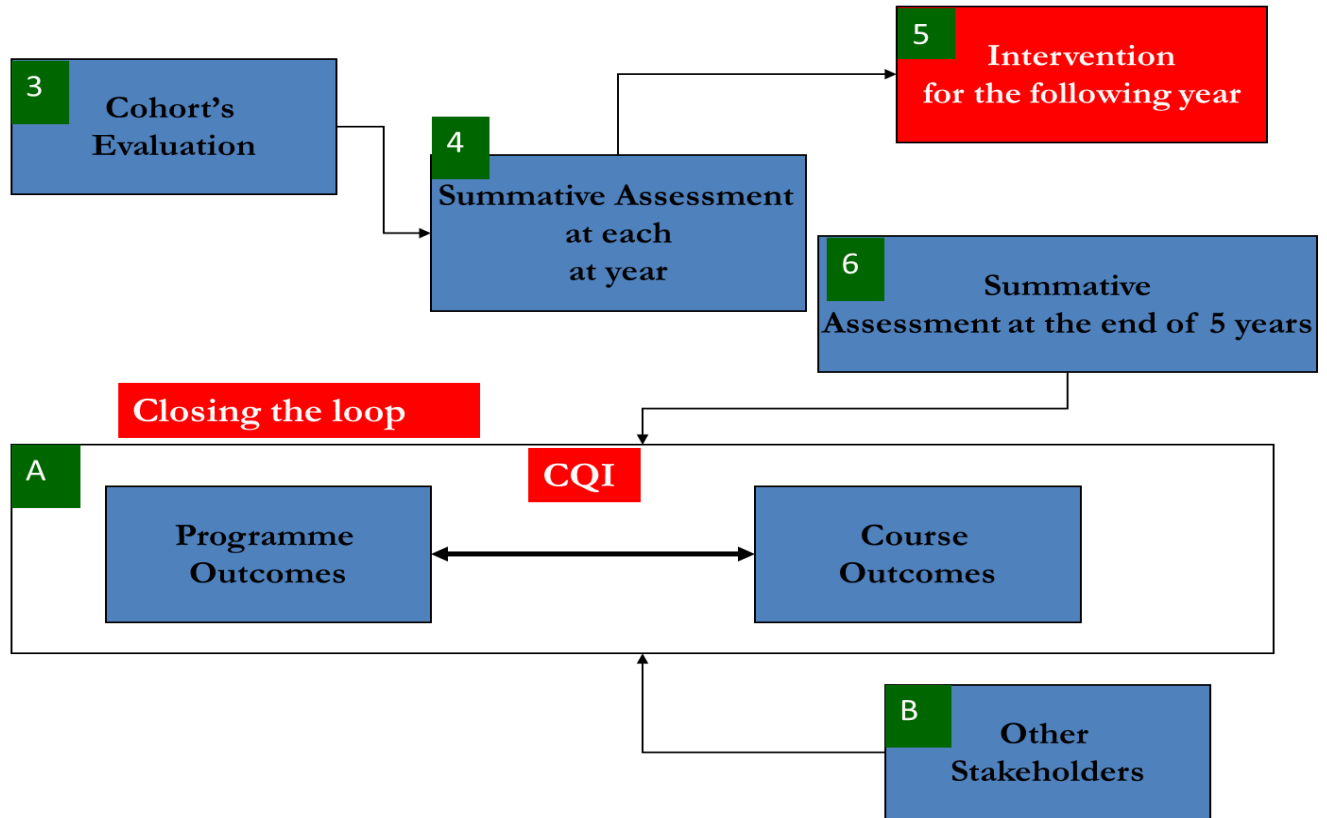


Figure 14: CQI of Course Outcomes and Programme Outcomes



8. STAKEHOLDERS FOR OBE

8.1. Key Stakeholders for OBE

1. Students
2. Academic Staff
3. Technical & Administrative Staff
4. Alumni
5. Employer
6. Parents
7. University Administrators
8. University Proprietors
9. COREN/ NUC

8.2. Roles of Academic Staff

1. Review PEOs, POs, course structures and syllabi.
2. Teach the relevant engineering, mathematics, and other relevant subjects.
3. Conduct relevant tutorials and laboratory practical sessions.
4. Give appropriate guide on assignments and projects.
5. Conduct empirical measurements of POs.
6. Prepare the required documentation.
7. Assure Stakeholders and public on the standard of our graduates.
8. Obtain and maintain accreditation from COREN through Continuous Quality Improvement (CQI).

8.3. Roles of Students

1. Know the required Programme Outcomes and Programme Educational Objectives (available at the institution website).
2. For each course, review the Course Learning Outcomes (available at the institution website) at the beginning of each semester. This gives an idea of the knowledge and skills expected from a particular course.
3. Be more proactive in the learning process to acquire the Learning Outcomes of subjects.
4. Demonstrate through the assessment methods that the required skills and knowledge have been acquired.
5. Attain the Programme Outcomes and Programme Educational Objectives immediately and 3-5 years after the entire programme respectively.
6. Give constructive feedbacks on the programme/course/academic staff in order to obtain accreditation through active participation in Online Teaching Evaluation, Academic Advisory System, dialog sessions with Dean, etc.

8.4. Roles of University Administrators / Proprietors

1. Provision of adequate teaching and learning facilities such as classrooms, learning-support facilities, study areas, information resources (library), computing and information-technology systems, laboratories and workshops, and associated equipment to cater for multi-delivery modes.

2. Provision of adequate support facilities such as hostels, sport and recreational centres, health centres, student centres, and transport in facilitating students' life on campus and enhancing character building.
3. Employment and retention of qualified and adequate teaching and non-teaching staff.
4. Provision of adequate financial resources and support to sustain and enhance the quality of the programme.

8.5.Roles of Employers/ Industry/ Alumni

1. Provision of conducive work environment
2. Provision of Industrial training placements for Engineering Programmes.
3. Participate in industrial advisory board of Engineering Programme
4. Encourage students to participate in industrial discussions and fora, professional practice exposure, and collaborative projects / research for the solutions to engineering problems.
5. Participate in students' activities and involvement in student organizations to provide experience in management and governance, representation in education and related matters and social activities.
6. Participate in the development/ review of PEOs, evaluation of the level of achievement of the PEOs and POs.
7. Provision of additional support to sustain and enhance the quality of the programme.

8.6.Roles of COREN/ NUC

1. Participate in the development/ review of PEOs and ensure adherence to the best practices towards achievement of the PEOs and POs.
2. Provision and enforcement of relevant benchmarks and regulatory framework to sustain and enhance the quality of the programme.
3. Organize difference sensitization programmes to enshrine OBE best practices and quality assurance.

9.0 OBE IMPLEMENTATION PROCESS

In order to ensure a successful implementation of OBE system, collaborative effort from all stakeholders such as administrators, educators, parent, teachers and students should be sought. This will enable an effective planning and implementation, and to guarantee commitment and decrease resistance. The basic characteristics and principles for OBE implementation would include (Creatrix Campus) :

1. Establish Institution Mission statements and Programme Educational Objectives
2. Engagement of diverse academic staff and ensure ownership and full commitment of the faculties or departments.
3. Map institution mission statements and Programme Educational Objectives (PEOs)
4. Define Programme Outcomes (POs) with Bloom's Taxonomy
5. Map Programme Educational Objectives with Programme Outcomes
6. Define CLO (Course Learning Objectives)
7. Define CLO (Course Learning Outcomes) with Bloom's Taxonomy for each Course
8. Map Courses with PO at suitable levels of Bloom's Taxonomy
9. Map CLO with PO at suitable levels of Bloom's Taxonomy
10. Map Assessment Pattern with CLO of each course
11. Map Topics with CLOs
12. Define pedagogical tools for course outcomes delivery. That is, provision of multiple instructional and assessment strategies that meet the needs of each student to allow adequate time and assistance for each student to reach the maximum potential.
13. Preparing session-wise Course Lesson Planner
14. Map Questions with CLO's at Bloom's Taxonomy levels & Assessments
15. Define rubrics with Bloom's Taxonomy and CLO
16. Track students performance by proposing proper remedial measures
17. Measure students performance against CLO threshold, course-wise
18. Measure students performance against PO threshold, semester-wise
19. Measure the attainment of each PO through Direct/Indirect assessments
20. Compare PO for last 3 academic years and propose remedial actions through effective leadership and staff collaboration
21. Assess the attainment of Programme Educational Objectives

10. CURRICULUM REVIEW

There must be a review of engineering curriculum to emphasize on:

1. Sustainability and Environmental Friendliness
2. Ethics and Professionalism
3. Soft-skills (Communications/Languages/ Emotional Intelligence/ Cultural)
4. Life- Long Learning
5. Project Management
6. Finance, Economics and Accountancy
7. Related Laws (Land Law/Contract Law/ By-Laws)

11. REFERENCES

- Bergen, R. (2000). A Program Guideline for Outcomes Assessment at Geneva College
- Bloom, B. S.; Engelhart, M. D.; Furst, E. J.; Hill, W. H.; Krathwohl, D. R.(1956). *Taxonomy of educational objectives: The classification of educational goals*. Handbook I: Cognitive domain. New York: David McKay Company
- Creatrix Campus, Anubavam Applying Experience ,
<https://www.creatrixcampus.com/blog/20-step-guide-implementing-outcome-based-education>
- Killen, R. (2000). Standards-referenced assessment: Linking outcomes, assessment and reporting. Keynote address to be presented at the Annual Conference of the Association for the Study of Evaluation in Education in Southern Africa, Port Elizabeth, South Africa, 26-29 September.
- Killen, R. & Spady, W. (1999). Using the SAQA critical outcomes to inform curriculum planning in higher education in South Africa. *South African Journal of Higher Education*, 14(1), 200-208.
- Krathwohl, D. R.; Bloom, B. S.; Masia, B. B. (1964). *Taxonomy of educational objectives: The classification of educational goals*. Handbook II: the affective domain. New York: David McKay Company.
- Nakkeeran, R, Babu, R, Manimaran, R; Gnanasivam, P. (2018). Importance of Outcome Based Education (OBE) to Advance Educational Quality and enhance Global Mobility, *International Journal of Pure and Applied Mathematics*, Volume 119, No. 17 (2018), 1483-1492 ISSN: 1314-3395 (on-line version) url: [http://www.acadpubl.eu/hub/ Special Issue](http://www.acadpubl.eu/hub/Special%20Issue) <http://www.acadpubl.eu/hub/1483>.
- Rasha Eldeeb and Nisha Shatakumari (2013), Outcome Based Education (OBE) - Trend Review, *IOSR Journal of Research & Method in Education (IOSR-JRME)* e-ISSN: 2320–7388,p-ISSN: 2320–737X Volume 1, Issue 2 (Mar. –Apr. 2013), Pp. 9-11.
- Simpson, Elizabeth (1972). "Educational objectives in the psychomotor domain" (PDF). **3**. Washington, D.C.: Gryphon House: 25–30. Retrieved 6 October, 2020.
- Spady, William G. (1994), *Outcome-Based Education: Critical Issues and Answers*. American Association of School Administrators, Arlington, Va.
- Spady, W. (1998). *Paradigm lost: Reclaiming America’s educational future*. Arlington, VA: American Association of School Administrators.
- Pohl Michael (2000). *Learning to Think and Thinking to Learning*: Hawker Brownlow Education.. Australia. 2000, 49.



Wilson, L. O. (2001). Bloom's Taxonomy Revised: Understanding the Revised Version of Bloom's Taxonomy. Available online at <https://thesecondprinciple.com/essential-teaching-skills/blooms-taxonomy-revised/>