COREN OBE ACCREDITATION CRITERIA

A WORKSHOP FOR PROGRAMME EVALUATORS OF OUTCOME-BASED ENGINEERING ACCREDITATION

BY

ENGINEERING ACCREDITATION COMMITTEE

COUNCIL FOR THE REGULATION OF ENGINEERING IN NIGERIA (COREN)

ON 26th NOVEMBER, 2024

Outcomes of the Workshop

At the end of this workshop, participants are expected to:

1. be aware of COREN OBE Accreditation Criteria.
2. understand the essential components of each criterion.
3. apply the essential components of each criterion in preparing Engineering Programme for COREN OBE accreditation visits.

Outlines of the Workshop

1. Programme Educational Objectives (PEOs)
2. Programme Outcomes (POs)
3. Course Learning Outcomes (CLOs)
4. Curriculum and Learning Process
5. Students
6. Continuous Quality Improvement (CQI)
7. Staffing
8. Physical Facilities and Infrastructures
9. Industrial Linkages and Community Services
10. Institutional Support and Funding

SECTION A:
COREN OBE ACCREDITATION CRITERIA

OBE Engineering Accreditation Criteria

1. Programme Educational Objectives (PEOs)
2. Programme Outcomes (POs)
3. Course Learning Outcomes (CLOs)
4. Curriculum and Learning Process
5. Students
6. Continuous Quality Improvement (CQI)
7. Staffing
8. Physical Facilities and Infrastructures
9. Industrial Linkages and Community Services
10. Institutional Support and Funding

Criterion 1: Programme Educational Objectives

What is expected a few years (say 3- 5 years) of graduation (What the programme prepares graduates in their career and professional accomplishments)

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

Characteristics of Good PEOs Statements Cont……

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**)

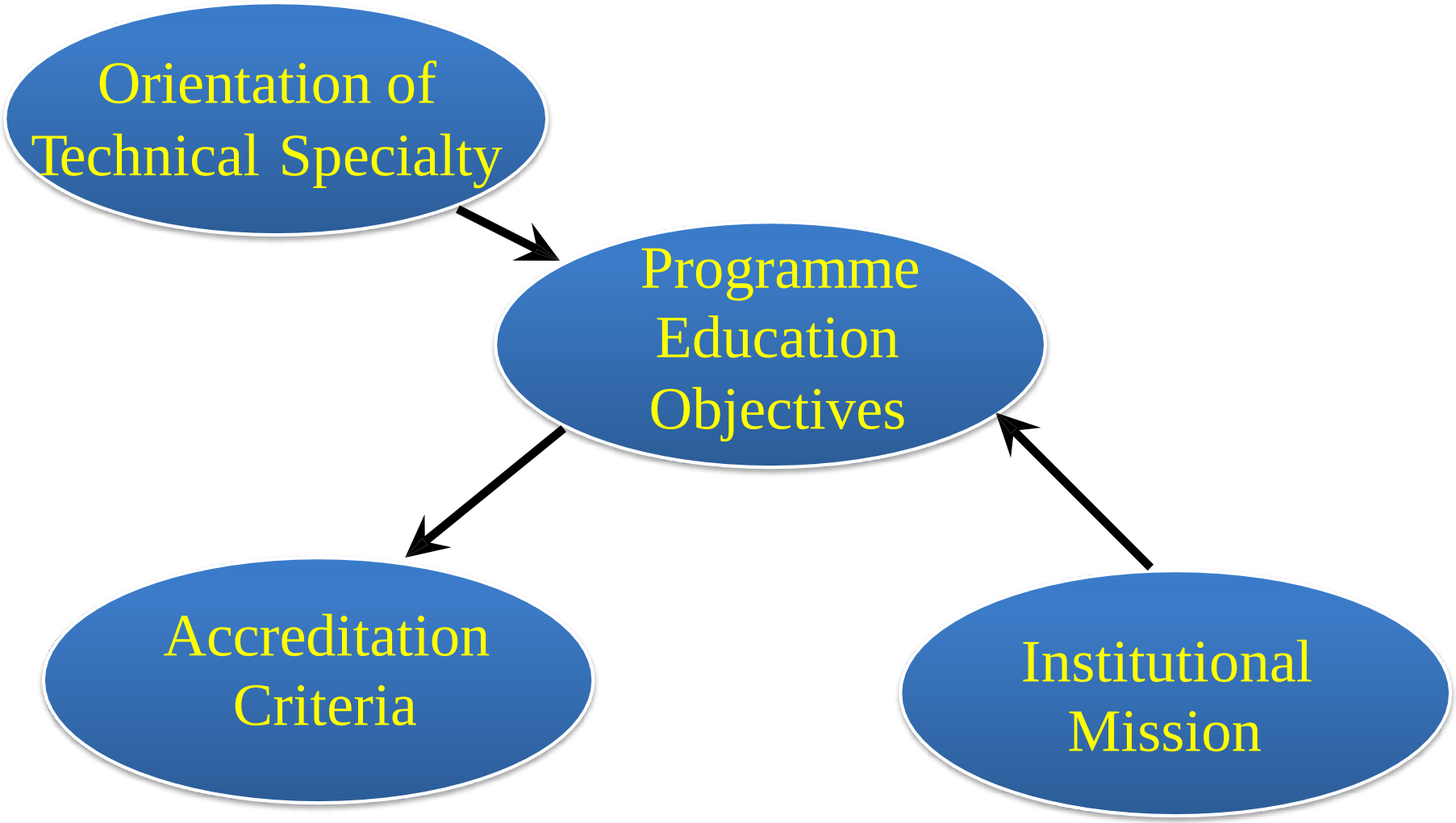
10. Clear, concise, consistent and reachable

11. Has clear link to the POs & curriculum design

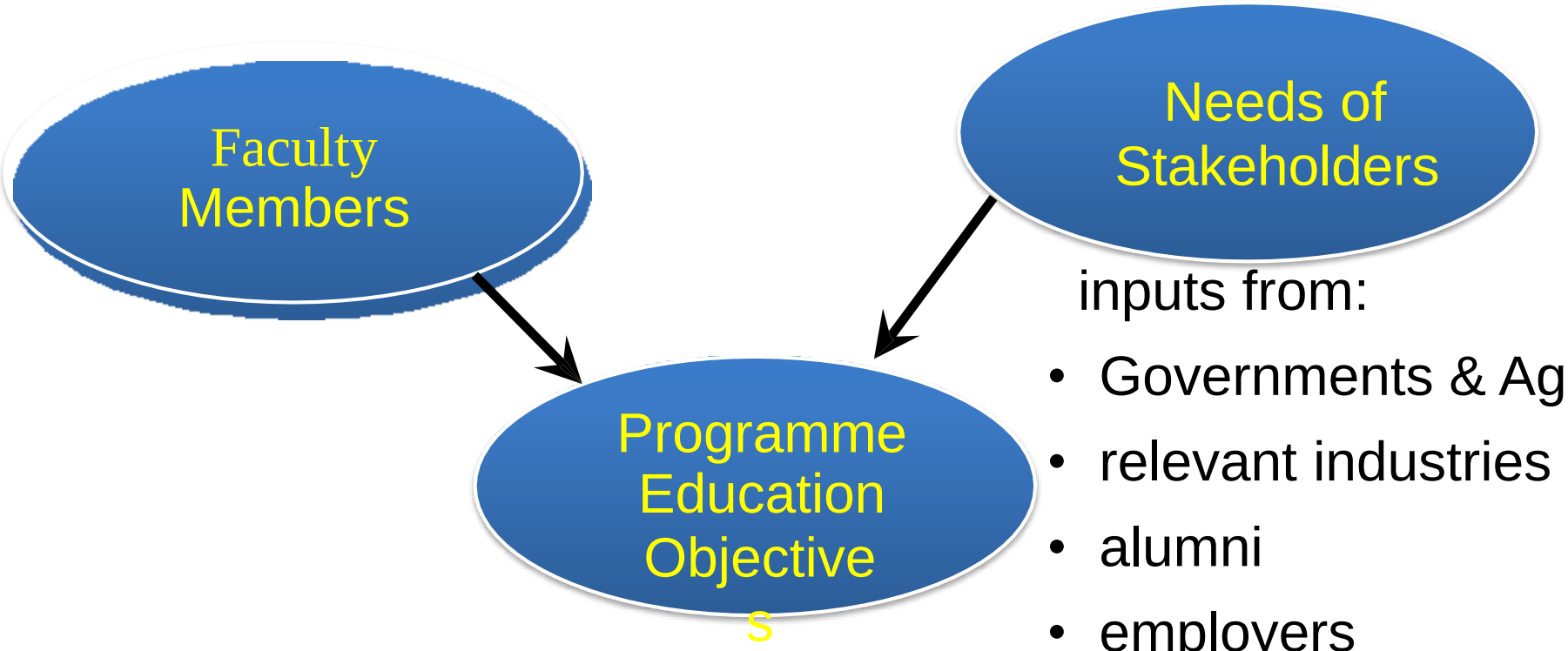
12. Reviewed, revised & updated continually

13. Published and Publicised

Characteristics of Programme Education Objectives



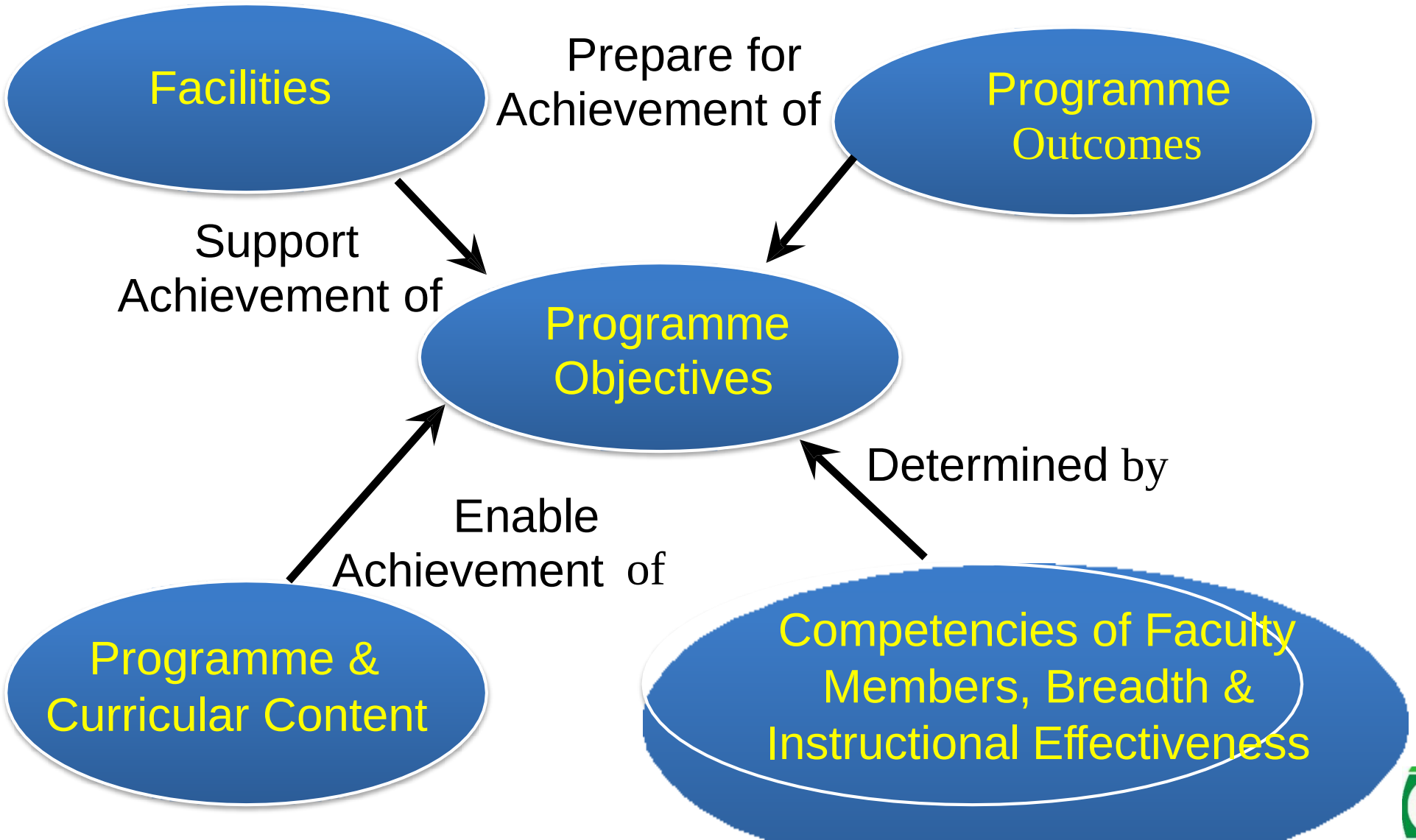
Development of Programme Education



inputs from:

- Governments & Agencies
- relevant industries
- alumni
- employers
- Students & lecturers
- Parents & administration

Programme Education Objectives



Summary of PEOs input

Input Method	Schedule	Constituent
Alumni survey	Every three years	Alumni 2-5 years out
Employer focus group	Every two years during Career Fair	Employers (and recruiters); some are alumni
Senior exit interview	Annually	Students; retrospective discussion of PEOs and their intended career paths
Advisory Council discussions	As needed—available annually	Industrial representatives, employers, alumni
Curriculum Committee meetings	Available as frequently as needed	Faculty and students

eg. Programme Educational Objectives (PEO)

- To provide graduates with sufficient knowledge in civil engineering and possess the necessary skills for work in the industry.
- To produce graduates who are sensitive and responsible towards the society, culture and environment.
- To prepare graduates for work in advanced design and innovation at international level.

Programme Educational Objectives (PEOs)

The programme aims at imparting quality education to agricultural engineering graduates for contributing to the society through modern technologies and practices.

After graduation, the Agricultural Engineers are expected to;

1. Demonstrate sound engineering knowledge and skills.

2. Execute and manage teamwork, interpersonal skills and professional growth.

3. Conduct professional practice considering societal, ethical, and environmental aspects.

Programme Educational Objectives (PEOs) …

The programme aims at imparting quality education to Telecom Engineering graduates for contributing to the society through modern technologies and practices.

The graduates of the programme will develop into professional engineers who will:

1. Demonstrate excellence in profession through in depth knowledge and skills in the field of Telecommunication Engineering.

2. Engage in continuous professional development and exhibit quest for learning, innovation and entrepreneurship.

3. Show professional integrity and commitment to social and ethical responsibilities.

Programme Educational Objectives (PEOs) …

The programme aims at imparting quality education to Textile Engineering graduates for contributing to the society through modern technologies and practices :

The graduates of the programme will develop into professional engineers who will:

1. Demonstrate sound engineering knowledge and skills.

2. Execute and manage teamwork, interpersonal skills and professional growth.

3. Conduct professional practice considering socio-economical, environmental, ethical, health and safety and cultural aspects.

Programme Educational Objectives (PEOs) …

The programme aims at imparting quality education to transportation engineering graduates for contributing to the society through modern technologies and practices.

Transportation engineering professionals will:

1. Actively engage in problem-solving using transportation engineering principles to address the evolving needs of the society.

2. Be able to succeed in positions in transportation engineering practice or research, they choose to pursue and enroll in advanced studies.

3. Make ethical decisions and demonstrate a commitment to service to the profession and society.

4. Acquire a position or degree that values adaptability and innovation in their chosen profession.

Programme Educational Objectives (PEOs) …

The programme aims at imparting quality education to Building & Architectural engineering graduates for contributing to the society through modern technologies and practices.

The Building & Architectural Engineers are expected to exhibit after graduation;

1. Sound knowledge along with effective teamwork, management and interpersonal skills.

2. Actively participate in activities for continuous growth and improvement in technical knowledge.

3. Undertake professional practice considering ethical, societal and environmental implications.

Programme Educational Objectives (PEOs) …

The programme aims at imparting quality education to Computer Engineering graduates for contributing to the society through modern technologies and practices.

The graduates of the program will able to:

1. Demonstrate excellence in profession through in depth knowledge and skills in the field of Computer Engineering.

2. Engage in continuous professional development and exhibit quest for learning, innovation and entrepreneurship.

3. Show professional integrity and commitment to social and ethical responsibilities

Programme Educational Objectives (PEOs) …

The programme aims at imparting quality education to Polymer Engineering graduates for contributing to the society through modern technologies and practices.

The graduates of the program will able to:

1. Demonstrate sound engineering knowledge and skills.

2. Execute and manage teamwork, interpersonal skills and professional growth.

3. Conduct professional practice considering socio-economical, environmental, ethical, health and safety and cultural aspects.

Typical PEOs Issues

- Do not meet PEO definition – accomplishments of graduates
  - Should be broad statements that describe what graduates are expected to attain within a few years
  - Should not contain Student Outcome language
    - ‘are capable of…’
    - ‘are equipped with…’
- Demonstration of constituent needs
  - Large number of constituents – many not involved in establishment/review of PEOs
  - Involvement is required – approval is not
- Process for revision not periodic or documented

Accreditation Questions on PEO

- How were the Educational Programme Objectives determined?
- Are they consistent with the institution missions?
- How does the institution accomplish the objectives?
- How is the review and update done?
- How does the institution knows that the objectives are met?
- Who are your stakeholders?
- How are the stakeholders involved?

Criterion 2: Programme Outcomes

What attributes (Knowledge, Skill and Attitudes) students should have by the time of graduation

COREN's 12 POs are identical to that of WA

There must be a clear linkage between Objectives and Outcomes

Need to distribute the outcomes throughout the programme, and not one/two courses only addressing a particular outcome

Criterion 2: COREN's 12 POs are identical to WA & GAs

Constituent Agreements

Washington Accord	International Professional Engineers Agreement
Sydney Accord	International Engineering Technologists Agreement
Dublin Accord	APEC Engineer Agreement

Graduate Attributes and Professional Competencies

Version 3: 21 June 2013

This document is available through the IEA website: http://www.ieagreements.org.

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. Need to distribute the outcomes throughout the programme, and not one/two courses only addressing a particular outcome.
4. Do not have to include measures or performance expectations.
5. There must be a clear linkage between Outcomes and 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.

COREN BMAS Programme Outcomes

A graduate of an engineering programme to be accredited by COREN is expected to have ability to:

1. **Engineering Knowledge:** apply knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of developmental and complex engineering problems.

2. **Problem Analysis:** identify, formulate, research literature and analyze developmental and complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.

3. **Design/Development of Solutions:** proffer solutions for developmental or complex engineering problems and design systems, components or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal and environmental considerations.

COREN BMAS Programme Outcomes Cont…

4. **Investigation:** conduct investigation into developmental or complex problems using research based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of information to provide valid conclusions.

5. **Modern Tool Usage:** create, select and apply appropriate techniques, resources and modern engineering and ICT tools, including prediction, modelling and optimization to developmental and complex engineering activities, with an understanding of the limitations.

6. **The Engineer and Society:** apply reasoning informed by contextual knowledge including Humanities and Social Sciences to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice.

COREN BMAS Programme Outcomes Cont…

7. **Environment and Sustainability:** understand the impact of professional engineering solutions in societal and environmental contexts and demonstrate knowledge of and need for sustainable development.

8. **Ethics:** apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice, including adherence to the COREN Engineers Code of Conducts.

9. **Individual and Team Work:** function effectively as an individual, and as a member or leader in diverse teams and in multi-disciplinary settings.

COREN BMAS Programme Outcomes Cont…

10. **Communication:** communicate effectively on developmental or complex engineering activities 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.

11. **Project Management:** demonstrate knowledge and understanding of engineering, management and financial principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multi-disciplinary environments.

12. **Lifelong Learning:** recognize the need for, and have the preparations and ability to engage in independent and lifelong learning in the broadest context of technological and social changes.

Assessment of Programme Outcomes

1. A listing and description of the assessment processes used to gather the data upon which the evaluation of each student outcome is based.

   Examples (not all inclusive): specific exam questions, student portfolios, internally developed assessment exams, senior project presentations, nationally-normed exams, oral exams, focus groups

2. The frequency with which these assessment processes are carried out
3. The expected level of attainment for each of the student outcomes
4. Summaries of the results of the evaluation process and an analysis illustrating the extent to which each of the student outcomes is being attained
5. How the results are documented and maintained

Assessment of Programme Outcomes…

The process of assessment and evaluation needs to demonstrate the degree to which outcomes are attained, however, there is no language

- ƒ that says all outcomes must be attained to the same degree
- ƒ that says anything about a numeric scale measuring degree of attainment
  - Although “degree” implies some quantitative gauge

Assessment of Programme Outcomes…

What about assessment data? What is adequate data?

- Does it **all** have to be objective/direct? (NO)
- Can it be subjective? (Some of it may be; nothing says it has to be)
- Is the observation or conclusion of course instructor adequate? (What was his or her basis for the observation?)

Does evidence for each outcome have to be in the form of work the student has produced? (No, however, the PEV & ultimately the team, needs to be convinced that outcome attainment has been demonstrated).

Accreditation Questions on POs

- How were the Programme Outcomes determined?
- Are they consistent with the institution missions and PEOs?
- How does the institution accomplish the outcomes?
- How is the review and update done?
- How does the institution knows that the outcomes are met?
- Who are your stakeholders?
- How are the stakeholders involved?

Criterion 3: Course Learning Outcomes

What attributes (Knowledge, Skill and Attitudes) students should have during or by the end of a course

Course Learning Outcomes

Course Content Development

This covers:

- ❖ Content – typical topics in the subject matters
- ❖ Subject Topics – teaching plan
- ❖ Course Learning Outcomes – group of learning (topic) outcomes

Considerations of:
Depth – e.g. Bloom's Taxonomy

Delivery and assessment

Students' time and competencies covered

Creating a Course Content

Planning

Identifying course content and defining measurable learning outcomes

Instruction

Select and implement methods – deliver the specified content and facilitate student achievement of the outcomes

Assessment and Evaluation

Select and implement methods – determine how well the outcomes have been achieved

Why are course outcomes important?

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.

Reasons for Careful Specification of Outcomes

1. They enable better planning of instruction and since they are end points they ensure lecturers know where they are going.

2. If the student knows where the lecturer is going they can direct their attention and effort to this goal a point.

3. They can improve performance assessment through and between test construction

4. They provide clearly defined parameters for evaluation

3 Essential Components of a Course Learning Outcomes:

1. Action verb (V): Describe behavioural action

Ability to:

- ***describe*** the principles used in designing X.
- ***evaluate*** the strengths and weakness of …

> ❖ Well-written verbs must be (observables) i.e. : (SMART)
> Specific, Measurable, Achievable ,Realistic, Time bound.
>
> ❖ Try to avoid using these (not observable) : appreciate , aware , familiar, know, learn, understand

Example 1:

describe the principles used in designing Z (V)

Example 2:

design a column (V)

Essential Components of a Course Learning Outcomes…

2. Condition (C) : Context under which the behaviour is to happen

- ***describe*** the principles used in designing X (V).
- ***orally describe*** the principles used in designing X. (V&C)

- ***design*** a beam. (V)
- ***design*** a beam ***using Microsoft Excel design template*** . (V&C)

Essential Components of a Course Learning Outcomes…

3. Standard (S) : Criteria of acceptable level of performance

- ***describe*** the principles used in designing X.(V)
- ***orally describe*** the principles used in designing X. (V&C)
- ***orally describe*** the **five** principles used in designing X. (V&C&S)

- ***design*** a beam. (V)
- ***design*** a beam ***using Microsoft Excel design template*** . (V&C)
- ***design*** a beam **using *Microsoft Excel design template*** based on ***BS 5950:Part 1.*** (V&C&S)

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).

Source: Bergen, R. 2000. A Program Guideline for Outcomes Assessment at Geneva College

Mapping

Courses	PO1	PO2	PO9	PO10
C1	3	2	1	1
C2	2	1	2	2
C3	3	0	3	2
C4	2	1	3	1

3, 2, 1, and 0 refer to High, Moderate, Low, and No emphasis, respectively.

C1..4 refer to the courses,

POs 1,2,9 and 10 refer to Programme Outcomes.

Examples

Vision and Mission of an Institution

Vision of the University

To be a premier university that propagates the generation and dissemination of knowledge in cutting edge technologies

Mission of the University

1. To deliver quality academic Programmes based on state-of-the-art R&D.
2. To attract and nurture quality minds who will contribute towards the global knowledge economy
3. To inculcate a strong research culture within a dynamic, efficient and effective team of academic and support staff
4. To be financially self-sustaining via education and the commercialization of R&D products and services.

Vision and Mission of a Faculty

Vision of the Faculty

To be a leading engineering faculty for creation, preservation and dissemination of knowledge, training of knowledge workers for nation building, and providing continuous technical support for the ICT industry.

Mission of the Faculty

1. To produce multi-skilled graduates who are able to spearhead nation-building in the Information Age.
2. To provide opportunities and resources for academic and researchers to carry out the state-of-the-art research and development work.
3. To support the growth of nationwide ICT industry through provision of continuous professional development of knowledge.

Programme Educational Objectives for B.Eng Electronics Majoring in Microwave & Comm.

PEO of B.Eng. (Hons) Electronics Majoring in Microwave and Communications

1. To develop highly competent engineers specializing in the area of microwave and communications technologies in support of the related industry.

2. To produce innovative technical leaders that are able to contribute towards the advancement of microwave and communications technologies.

PEOs and Vision and Mission of a Discipline and Faculty

Example of how PEOs are linked to the Vision and Mission

Vision of the Faculty	Mission of the Faculty	Programme Educational Objectives (PEOs)
To be a leading engineering faculty for creation, preservation and dissemination of knowledge, training of knowledge workers for nation building, and providing continuous technical support for the ICT industry	1. To produce multi-skilled graduates who are able to spearhead nation-building in the Information Age 2. To provide opportunities and resources for academic and researchers to carry out the state-of-the-art research and development work 3. To support the growth of nationwide ICT industry through provision of continuous professional development of knowledge	1. To develop highly competent engineers specialising in the area of microwave and communications technologies in support of the related industry. 2. To produce innovative technical leaders that are able to contribute towards the advancement of microwave and communications technologies.

Mapping of POs aganist PEOs of a Programme

Example of how POs are linked to the PEOs

Programme Educational Objectives (PEOs)	Description of how POs (Programme Outcomes) are linked to the PEOs
1. To produce all-rounded engineers in the telecommunications technologies in support of the emerging ICT industry **2. To develop capable technical leaders who are able to spearhead the advancement of telecommunications in the country.**	**1. Ability to acquire and apply fundamental principles of science and engineering.** - *The graduates have firm fundamental knowledge and therefore can easily understand and adapt to any change in the technology* - *This will ensure that the graduates will be of high caliber equipped with the fundamental technical principles of science and engineering so that they can lead, facilitate and support the development of engineering practices in the industries in Malaysia* - *Related to PEO 1*
	2. Capability to communicate effectively - *Communication and networking skills are enhanced through presentations, exchanging ideas and arguing with solid rational* - *To be a good leader, effective communication is a must* - *Related to PEOs 1 and 2*

Mapping of CLOs aganist POs of a Programme

Example of how the course subjects contribute towards POs

Programme Outcome	Descriptions
Ability to acquire and apply fundamental principles of science and engineering	- Core subjects on Mathematics (Engineering Mathematics I to IV), Circuit Theory, Electronics (I to III), Computer & Program Design, Field Theory, Digital Logic Design, Instrumentation & Measurement Techniques, Introduction to Machines, Algorithm & Data Structure, Microprocessor Systems & Interfacing, Circuits and Signals, Electromagnetic Theory, Control Theory, Communication Networks, Electromagnetic Interference, Introduction to Power Systems. - Basic concepts and theories and their relation to actual engineering systems are applied and extended in Final Year Projects and Industrial Training. - Extensive laboratory experiments to provide in-depth practical knowledge and hands-on experience to students.

Assessment Methods for POs

Example of Assessment Methods for Programme Outcome 2: Capability to Communicate Effectively

Performance Criteria	Courses	Assessment Methods	Documents to be Kept
• Present and document ideas and experimental results properly documented in a specified format, and supported with evidence. The document must contain explanation with sufficient detail, with minimum grammatical and spelling errors.	• All Courses and Lab Experiments, Mini Projects	• Coursework and exam • presentation of Final Year Project and Industrial Training reports • Lab Reports	Exam scripts and assignment Final Year Project and Industrial Training reports and mark sheets, lab reports,
• Use multimedia content in oral and visual communication	• EPT4046 Final Year Project, EPT4066 Industrial Training • Mini Project • Other Seminars, and • Meetings	• Presentation of Final Year Project, Industrial Training, Mini projects and other seminars	Final Year Project and Industrial Training, Mini Projects mark sheets, PowerPoint presentation slides. Attendance records in other seminars
• Respond to audience's questions correctly and confidently	• EPT4046 Final Year Project, EPT4066 Industrial Training, • EPT3016 Mini Project, • other seminars and • meetings	• Presentation of Final Year Project, Industrial Training, Mini projects and other seminars	Final Year Project and Industrial Training, Mini Projects mark sheets, PowerPoint presentation slides. Student attendance

CLOs of a Course

Course Learning Outcomes (CLO) of subjects are statements of a learning achievement on completion of the subject.

LOs of EET 536 Digital Logic Design:

1. Describe the differences between analog and digital systems, and their respective advantages and disadvantages.
2. Apply positional notations, number systems and computer codes in digital systems.
3. Apply algebraic methods based on Boolean algebra and truth table to analyse logic circuits.
4. Apply minimization methods such as Karnaugh maps and Quine-McCluskey tabular method to simplify switching functions.
5. Apply the concepts of sequential logic and memory devices in digital systems.
6. Design modular combinational circuits using encoders, decoders, multiplexers and demultiplexers.

Course Outcomes – derived from Teaching Plan

- **Topics** – to be grouped in weekly or hourly (could be according to activity)
- **Programme Outcomes** for each topic – specific and measurable
- **Delivery methods** – indicate if they are Lecture, PBL, Case Method, site visit etc.
- **Hours -** Contact hours between lecturer-students, Student learning hours and lecturer grading/ advising hours
- **Assessment** – indicate on how and where the learning outcomes will be measured (for course evaluation)
- **Course Learning Outcomes** – group the learning outcomes into several course outcomes.
- **Map** Course Learning Outcomes to Programme Outcomes

Bottom Up Approach

Course to Programme Outcomes Mapping

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										

Course Learning Outcomes (CO) Contribution to Programme Outcomes (PO)

Ability to function in multidisciplinary team

1. Assign multidisciplinary design projects in 1st year engineering courses.
2. Implement senior design projects with multidisciplinary teams
3. Simulate multidisciplinary teamwork in Final year design projects

Course Outcomes (CO) Contribution to Programme Outcomes (PO)

Broad education necessary to understand the impact of engineering solutions in a global, environment and societal context + knowledge of contemporary issues

1. Include one or two structured controversies in engineering course
2. Include instructional materials, written student products in course portfolio
3. Put in some class exercises and homework problems that involve global/societal issues in several engineering courses, including 1st year engineering and capstone design courses

Course Outcomes (CO) Contribution to Programme Outcomes (PO)

Life Long Learning

1. Teach students about learning styles and help them identify the strength and weakness of the their styles and give them strategies to improve
2. Use active learning methods to accustom them to relying on themselves
3. Give assignments throughout the programme year that require library and www searches
4. Anything done to fulfil criteria on: understanding *ethical and professional responsibility* and understanding *societal and global context of engineering solutions*, will automatically satisfy this criterion

Some Current Issues for Educators

Learning

- Prescriptive*: Students would be exposed to the C language – what is taught*

as compared to the OBE approach

- Outcomes *: Students should be able to make use of the C language in programming – what is learned*

Course Learning Outcomes

1. Statement … explain, calculate, derive, design, critique.

2. Statement … learn, know, understand, appreciate – not learning outcomes but may qualify as outcomes (non-observable).

3. Understanding cannot be directly observed, student must do something observable to demonstrate his/her understanding.

Checklist for Writing Course Learning Outcomes

1. Focus on outcomes, not processes
2. Start each outcome with an action verb.
3. Its good to use only one action verb per learning outcome
4. Avoid vague verbs such as *know* and *understand*.
5. Check that the verbs used reflect the level of learning required.
6. Ensure that outcomes are observable and measurable.
7. Write the outcomes in terms of what the learner does, not what the instructor does.
8. Check that the outcomes reflect knowledge, skills, or attitudes required in the workplace.
9. Include outcomes that are woven into the entire course (such as *work effectively in teams*).
10. Check that there are the appropriate number of outcomes (no more than three per major topic)
11. List the sub-outcomes for each outcome
12. Check that the outcomes fit within programme and course outcomes

Teaching Plan

- Plan-do-check-act (PDCA)
- Plan the class of 42 hours, if teaching a 3 credit course

What to consider when preparing a teaching plan?

1. From each topic – what is the learning outcomes
2. Remember – something that you can measure (think about assessment tools)
3. Do your learning outcomes address your course outcomes and programme outcomes?
4. Consider students' contact hours
5. Consider class or instructor contact hours
6. Identify delivery methods
7. A delivery method can address many outcomes but remember you must know how to assess at the end
8. What do you want the students to do in order to learn?
9. What are the preparations that an instructor has to do to ensure learning?

What to consider when preparing a teaching plan?...

10. Write an executive summary of how you are going to facilitate learning in your course (remember you must be able to demonstrate that learning has taken place)
11. The assessment (exam, test, quiz) questions, assignments, and observations (what you can observe you can measure) should be expanded further.
12. Thee is a need to know the students in order to be able to observe and record students participation

Typical Teaching Plan Format
Remember KSA

Topics	Course outcome	Delivery method	Assessment	Indicator	Students contact time	Instructors contact time

Exercise
Scenario

- Federal University of Technology, Minna decided to start a new “general” engineering programme (B Eng) in addition to the existing five programmes. The existing programmes have only one common programme educational objective, i.e., “to produce engineers (according to the related field). The team which includes you is responsible to develop the new programme, and had decided to expand the programme objectives to include
  - Global player
  - Leading in advanced design

Questions

1. Identify the appropriate POs for the new programme, and link them to the PEOs
2. Identify the suitable taxonomy level for the respective POs.
3. A course, Strength of Materials (EET215) has been identified as a fundamental course for the new programme. Develop the course learning outcomes and identify the appropriate taxonomy level.
4. How would you assess the course's cognitive outcomes?
5. If you have to include non-cognitive outcomes, what are the possible assessment techniques to be employed?
6. Establish a mechanism to demonstrate attainment of the course learning outcomes (both formative and summative)
7. Show how the course learning outcomes contribute to the programme outcomes.

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EET215: STRENGTH OF MATERIALS (2 CREDIT UNITS)
(synopsis)

Single stress and strain. Bending Moment and shear force Diagrams. Slope Deflection. Cantilever and simply supported Beans. Torsion of Circular Shafts, angle or twist, twisting couple, statically indeterminate problems. Centroid, moment of criteria, second moment of area, product of inertia.

BREAK ! BREAK !! BREAK !!!

Criterion 4– Curriculum and Learning Process

- Incorporate inputs from all stakeholders especially from the industry, in developing curriculum contents so as to keep the curriculum aligned with the PEOs and POs.
- The programme structure covers the essential fundamental principles at the initial stages, leading to integrated studies in the final year of the programme in agreement with different levels of Bloom's taxonomy defined.
- A minimum of 30 semester credit hours (or equivalent) of a combination of college-level mathematics and basic sciences with experimental experience appropriate to the programme.
- $\leq$ 85 semester credit hours (or equivalent) of engineering topics appropriate to the programme, consisting of engineering and computer sciences, engineering design, and utilizing modern engineering tools.

Criterion 4– Curriculum and Learning Process…

- A major engineering design experience that incorporates appropriate engineering standards and multiple constraints, and is based on the knowledge and skills acquired in earlier course work.
- 5-year, 10-semester programme (UTME students).
- 4 & 3 year for Direct Entry Students.
- Minimum Fifteen (15) weeks of teaching, excluding time of examination(s)
- The general framework defined by National Universities Commission (NUC) Curriculum Guideline and COREN BMAS (2017).
- Industrial training programme
- Laboratory work
- Design projects
- Final year project
- Assessment of learning outcomes

Chinese Proverb

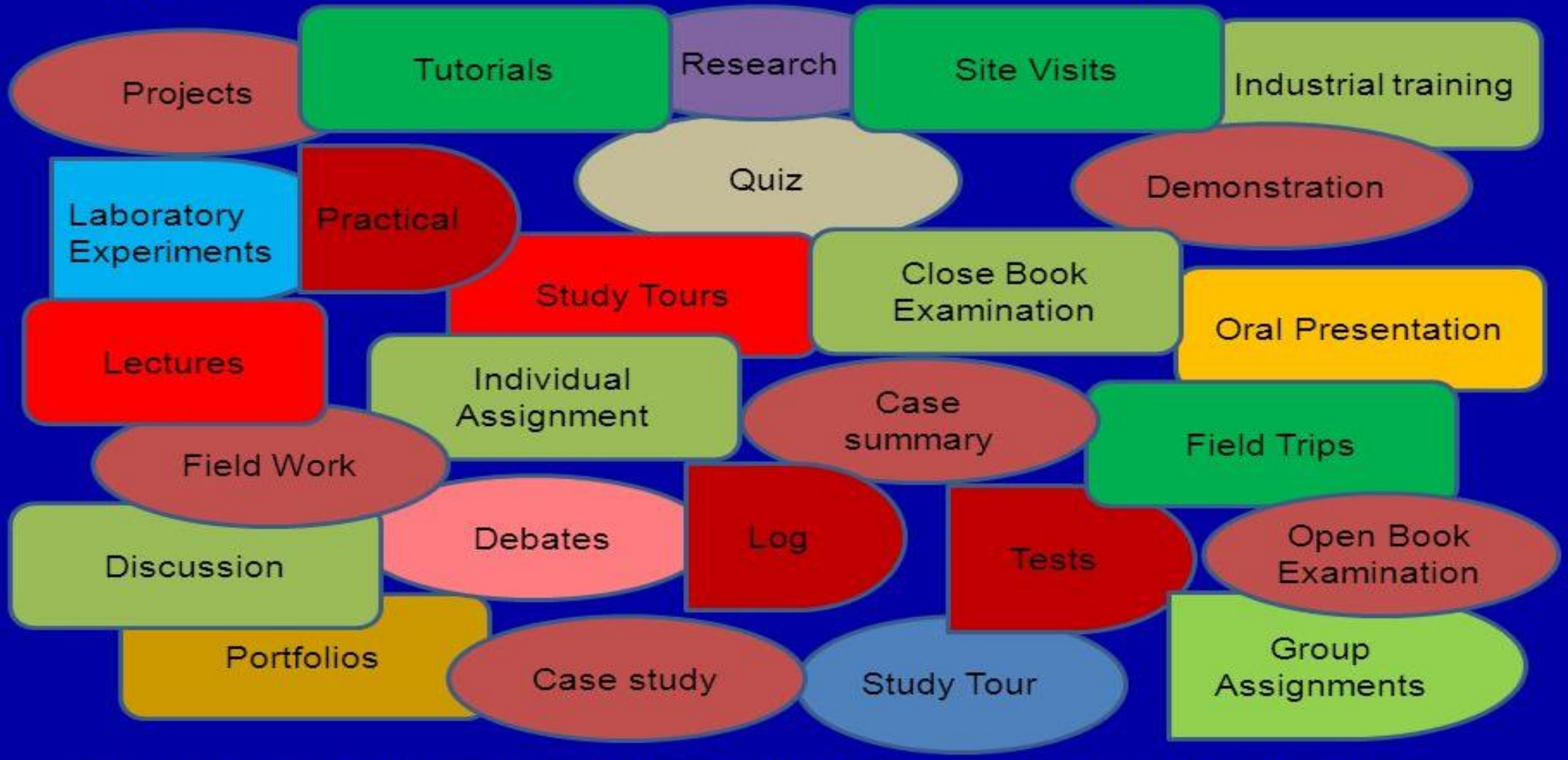
Tell me and I will forget

Show me and I will remember

Involve me and I will understand

Step back and I will act

*Types of Teaching/Learning Delivery Activities**



**Any assessment of learning activities and outcomes must come with systematic assessing criteria and marking scheme*

COREN

Instructional Procedure to Help Students achieve specific outcomes

For all students to learn well and to achieve specific outcomes, teachers must :

1. Prepare their students adequately so that they can succeed. Teachers must understand exactly what they want students to learn, anticipate difficulties that students might have and plan to minimize these difficulties.

2. Create a positive learning environment in which students know that they will be helped in their learning no matter how easy or difficult they might find the learning process.

3. Help their students to understand what they have to learn, why they should learn it (including what use it will be to them in the future), and how they will know when they have learned it.

Instructional Procedure to Help Students achieve specific outcomes…

4. Use a variety of methods of instruction in order to help each student to learn.

5. Provide students with sufficient opportunities to practice using the new knowledge and skills that they gain, so that under the teacher's guidance they can explore and experiment with their new learning, correct errors and adjust their thinking.

6. Help each student to bring each learning episode (lesson or group of lessons) to a personal closure so that they are aware of what they learned and where it is leading them.

Note: If teachers want to be successful with their outcomes-based programming, they need to look at it from their students' perspective.

Teaching Strategies for Outcome-Based Education

1. The main focus should be on **LEARNING** rather than teaching.

2. Students cannot learn, if they do not **THINK**.

3. Thinking is facilitated and encouraged by the **PROCESSES** that teacher use to engage students with the content, as well as by the **CONTENT** itself.

4. There is nothing that exist in isolation— Stakeholder have to help students make **LINKS** to other subjects.

5. Teacher have a responsibility to help students **LEARN HOW TO LEARN**

Components of An Outcomes-Based Programme

1. A clear set of outcomes that all students will achieve (if you like, a minimum set of outcomes). Teachers will need to **select**, from all the possible outcomes, those that should be given top priority.

2. A clear set of suitably graded extension outcomes for those students who progress beyond the minimum outcomes. These extension outcomes should provide students with a deeper understanding of the issues being studied, rather than take them on to the next issue that all students will study.

3. A detailed specification of the prerequisites that students must master before attempting to achieve each new outcome.

4. Plans for several different teaching strategies that can be used to help students achieve the desired learning outcomes.

Components of An Outcomes-Based Programme …

5. Plans for guided practice sessions during which students can receive feedback on their progress towards the learning outcomes.

6. A variety of tests to provide both the teacher and the students with feedback.

7. A variety of mastery tests (at different levels).

8. Resources and teaching techniques to assist students who do not master the required outcomes as quickly as other students

Student Responsibility for Learning

1. The principle of OBE acknowledges the fact that, ultimately, no matter what teachers do, learning is an internal and personal event.

2. The teacher cannot learn for his/her students; the teacher can only facilitate that learning.

3. OBE emphasizes the teacher's responsibility to clearly define the outcomes and to assist students to achieve those outcomes.

4. It is learner's responsibility to try to achieve the outcomes.

5. OBE help students to become aware of what they should be learning, aware of what they are actually learning, and aware of the control that they have over their own learning.

Socratic Concept

Knowledge originates from the pupils through the skillful questioning of the teacher

Course File

The course-file helps to monitor and evaluate the effectiveness of the delivery of the course.

Engineering programme is required to maintain course- file for each course taught in the curriculum.

A typical course file must include all relevant data such as:

- Course Description: contents, recommended text books, lecture breakdown, office hours for students, CLOs with taxonomy levels and their mapping to POs, Assessment tools and their weightage, grading policy etc.

- Schedule of sessional/mid-term tests and final examination.

- Samples of best, worst and average answer sheets, along with the question paper and model solutions of each sessional(s)/midterm/quizzes/assignments and final examination.

Course File

- Record of make-up classes for any un-scheduled holiday.
- Breakdown of laboratory experiments pertaining to the course and record of successful conduct.
- Record of CLOs assessment and attainment
- Instructor course feedback form
- Recommendation and suggestions related to the course for the next session. (Course Report)

Discuss how curriculum supports the achievements of POs?

Criterion 5 - Students

1. Admission criteria
2. Annual intake
3. Admission response
4. Transfer of students
5. Academic counseling
6. Career and student wellness counseling

Criterion 5 – Students Cont….

7. Class size (theory and practical)
8. Maintain a manageable Semester academic load
9. ensure and document that students who graduate meet all graduation requirements.
10. Completion of courses and student feedback
11. Participation in competition
12. Student performance evaluation
13. Provision of adequate opportunities for students to develop their character apart from academic development. such as student clubs, sports and campus activities,

Student Performance Evaluation

- Identify the various mechanisms that can be use to evaluating students' performance in different courses of the programme, their suitability and effectiveness for assessing the level of achievement of course learning outcomes.

- This may include a review of various class assignments, quizzes, research reports, examinations as well as lab projects and viva-voce.

- Ensure a good number of different assessment tools and their coverage of subject topics in order to have a reasonably accurate assessment of students' level of achievement against various learning outcomes.

Criterion 6–Continuous Quality Improvement (CQI)

- The programme **must** regularly use appropriate, documented processes for assessing and evaluating the extent to which the Programme Outcomes are being attained.

- The results of these evaluations **must** be systematically utilized as input for the continuous improvement of the programme

- Other available information **may** also be used to assist in the continuous improvement of the programme

What does Continuous Quality Improvement Mean?

An educational program process should involve a clear understanding of:

- Mission
- Constituents
- Objectives (what someone is trying to achieve)
- Outcomes (learning that takes place to meet objectives)
- Processes (internal practices to achieve the outcome)
- Facts (data collection)
- Evaluation (interpretation of facts)
- Action (change, improvement)

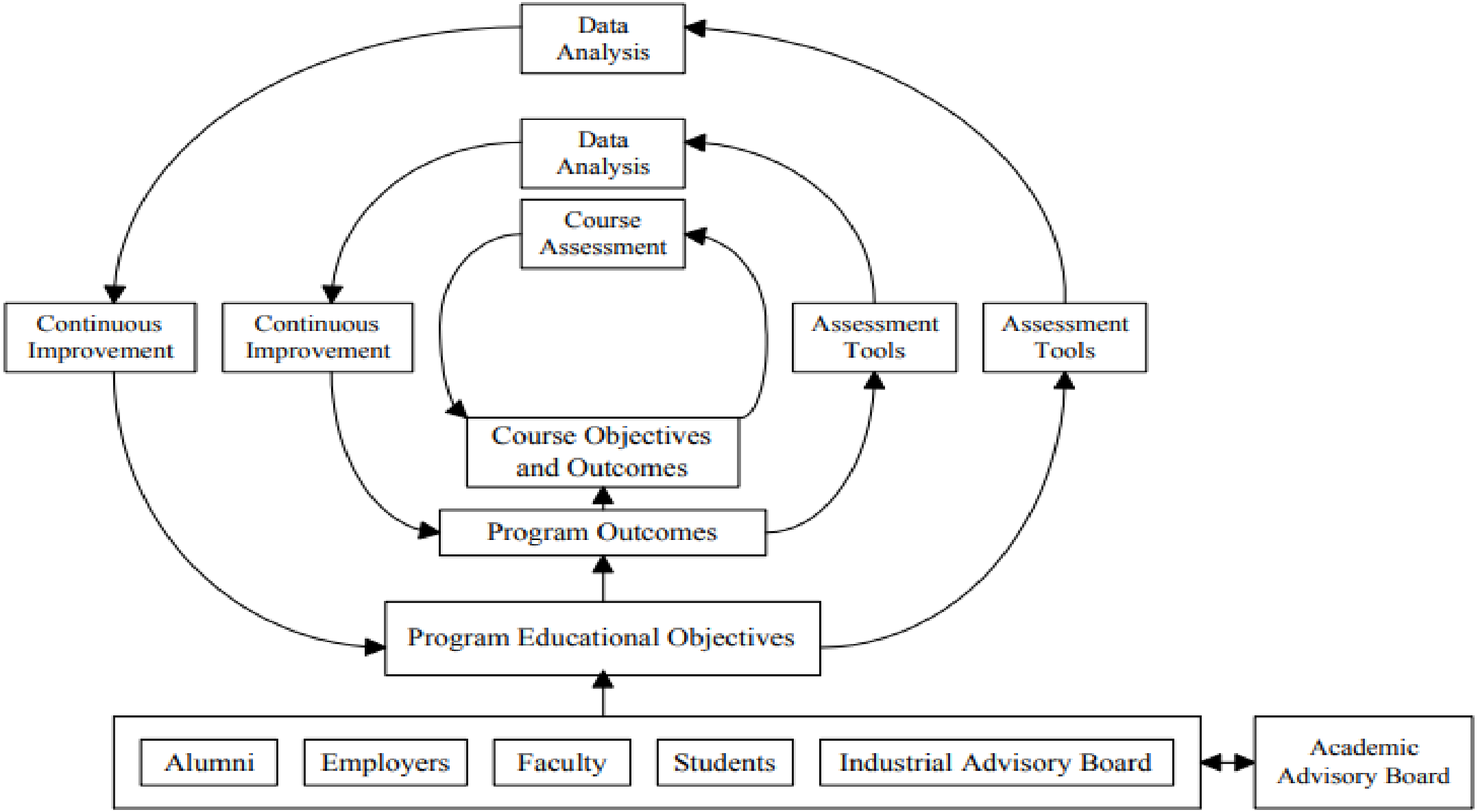
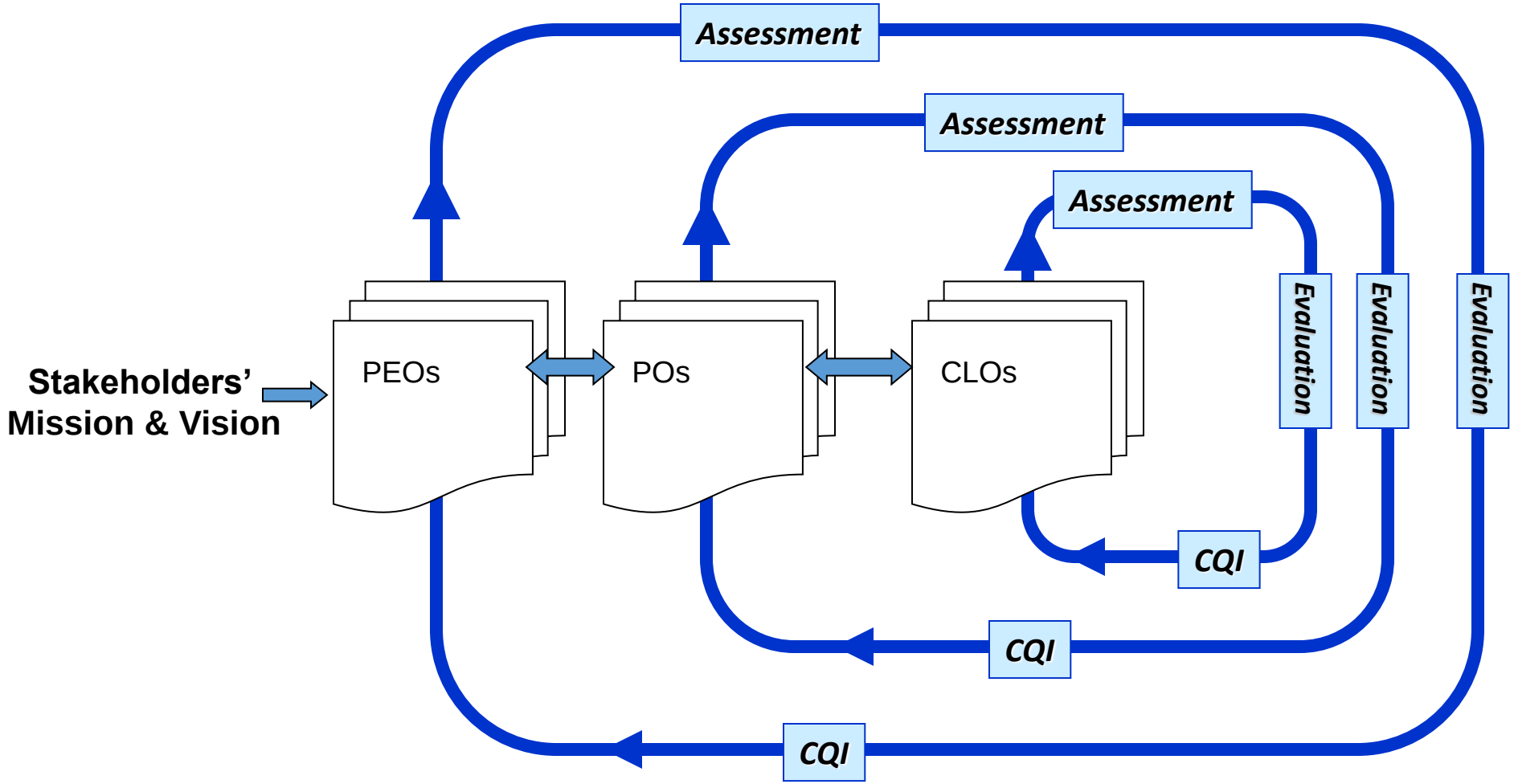


Figure 2: Continuous improvement loops for the program.

Continous Quality Improvement (CQI) Cont….



Continuous Quality Improvement

- Describe how the results of evaluation processes for the student outcomes and any other available information have been systematically used as input in the continuous improvement of the program.

- Describe the results of any changes (whether or not effective) in those cases where re-assessment of the results has been completed.

- Indicate any significant future program improvement plans based upon recent evaluations.

- Provide a brief rationale for each of these planned changes

Continous Quality Improvement (CQI) Cont….

(a) Exam System
(b) Library System
(c) Administration System
(d) HR or Finance Division

But it includes a Feedback System on
(a) Curriculum Review
(b) Facility Improvement
(c) Delivery
(d) Attainment of Outcomes

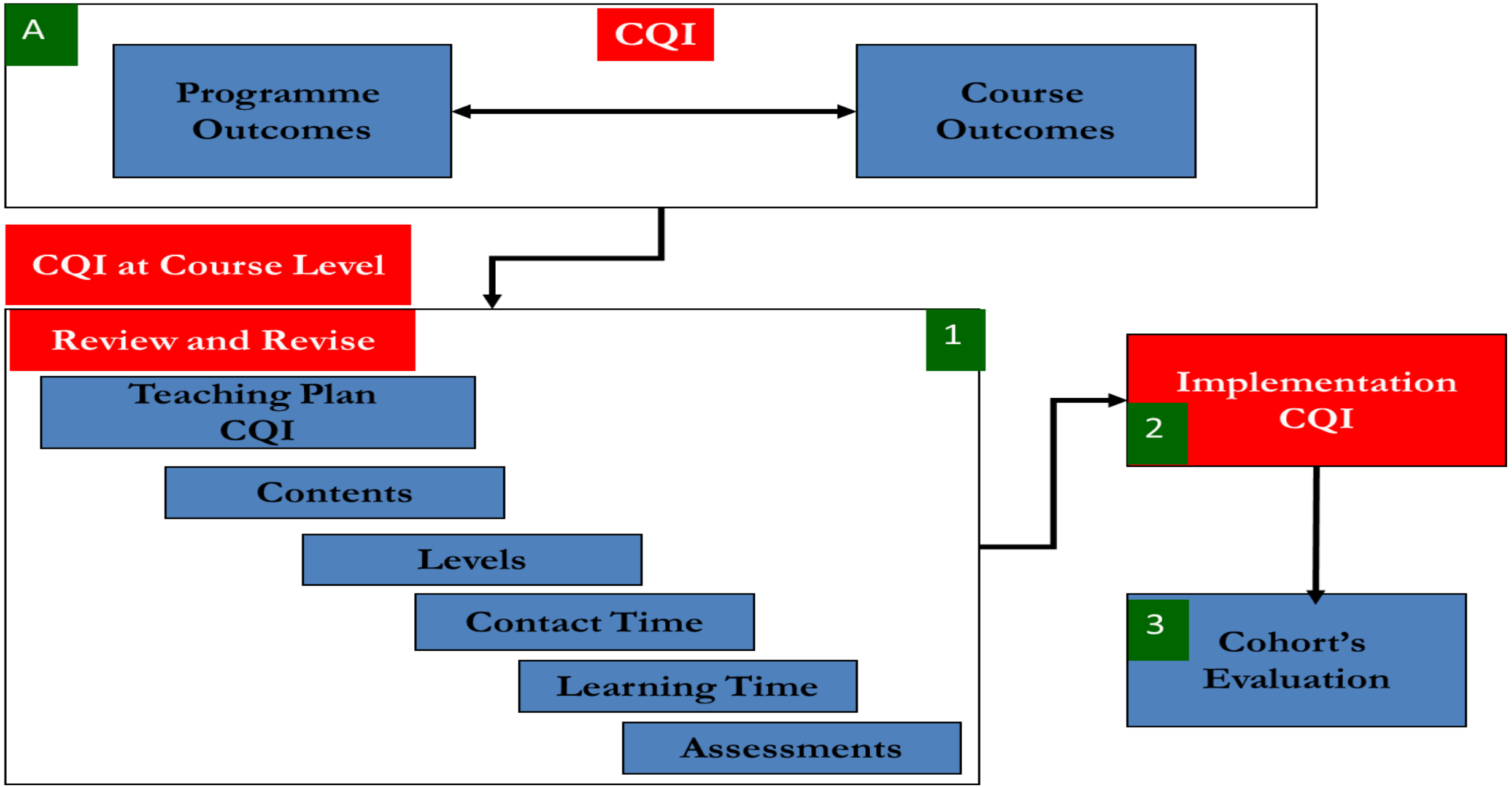


Figure: CQI of Course Outcomes and Programme Outcomes (Abdul Aziz & Mohd Noor, 2014)

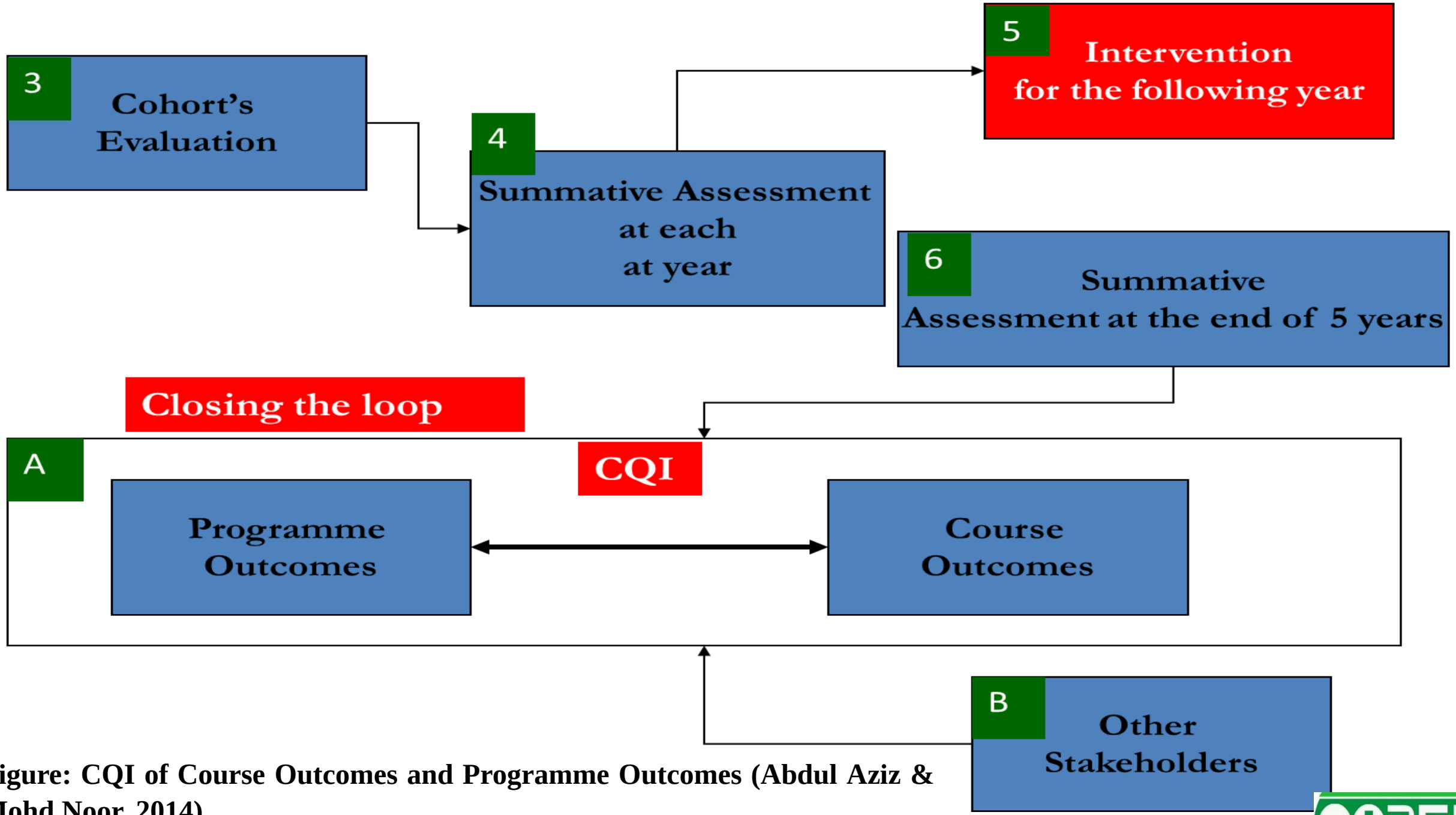


Figure: CQI of Course Outcomes and Programme Outcomes (Abdul Aziz & Mohd Noor, 2014)

Criterion 7–Staffing

1. Academic Staff strength
2. Full-time dedicated Academic Staff
3. Shared Academic Staff
4. Visiting Academic Staff
5. Academic Staff qualifications
6. Student/faculty ratio

Criterion 7–Staffing…

7. Staff training & mentoring
8. Staff Retention, Development and Career Planning
9. Pyramid of Academic Structure
10. Staff workload
11. Staff Research & Publications

Criterion 8–Physical Facilities and Infrastructures

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

2. adequacy of support facilities such as hostels, sports and recreational centres, health care centres, student centres, and transport in facilitating students' life on campus and enhancing character building.

Criterion 9: Industrial Linkages and Community Services

1. Opportunity to students for training, consultancy, R&D and exposure to professional practices.

2. Students are expected to undertake assignments from industry to provide solutions to complex engineering problems.

3. Students and faculty encouraged to establish collaboration for R&D and product development related projects, with due regard to environmental and societal impact.

4. Feedback from the industry and employers is crucial and an essential part of curriculum review process used to evaluate attainment of the program objectives.

Criterion 10: Institutional Support and Funding

1. Financial resources and their commitment to support an engineering programme.

2. Adequacy of these resources in sustaining the program, with a view to its up-gradation and future enhancements

EXERCISES

1. How can the relationship between Engineering Programmes in Nigerian Universities and the industry be developed and sustained?

2. Are the institutional support and funding of Engineering Programme in Nigeria Universities adequate enough to produce graduates that are innovative and creative enough to compete in a global economy of the 21st century society?

   If **no**, suggest possible ways to secure more support and funding for Engineering Programme in the universities

To compete in a global economy of the 21st century society, a country requires a workforce (Engineer) that:

1. can solve problems
2. is committed to ongoing learning
3. is creative
4. has above-average communication skills
5. is in line with new technological developments
6. is flexible
7. can participate in management processes and decision-making and
8. can work interactively.

Thank you

The End

Q & A

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