

# ASSESSMENT AND EVALUATION OF POs



A WORKSHOP FOR PROGRAMME EVALUATORS OF OUTCOME-BASED  
ENGINEERING ACCREDITATION

BY

ENGINEERING ACCREDITATION COMMITTEE  
COUNCIL FOR THE REGULATION OF ENGINEERING IN NIGERIA (COREN)

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# OUTCOMES OF THE WORKSHOP

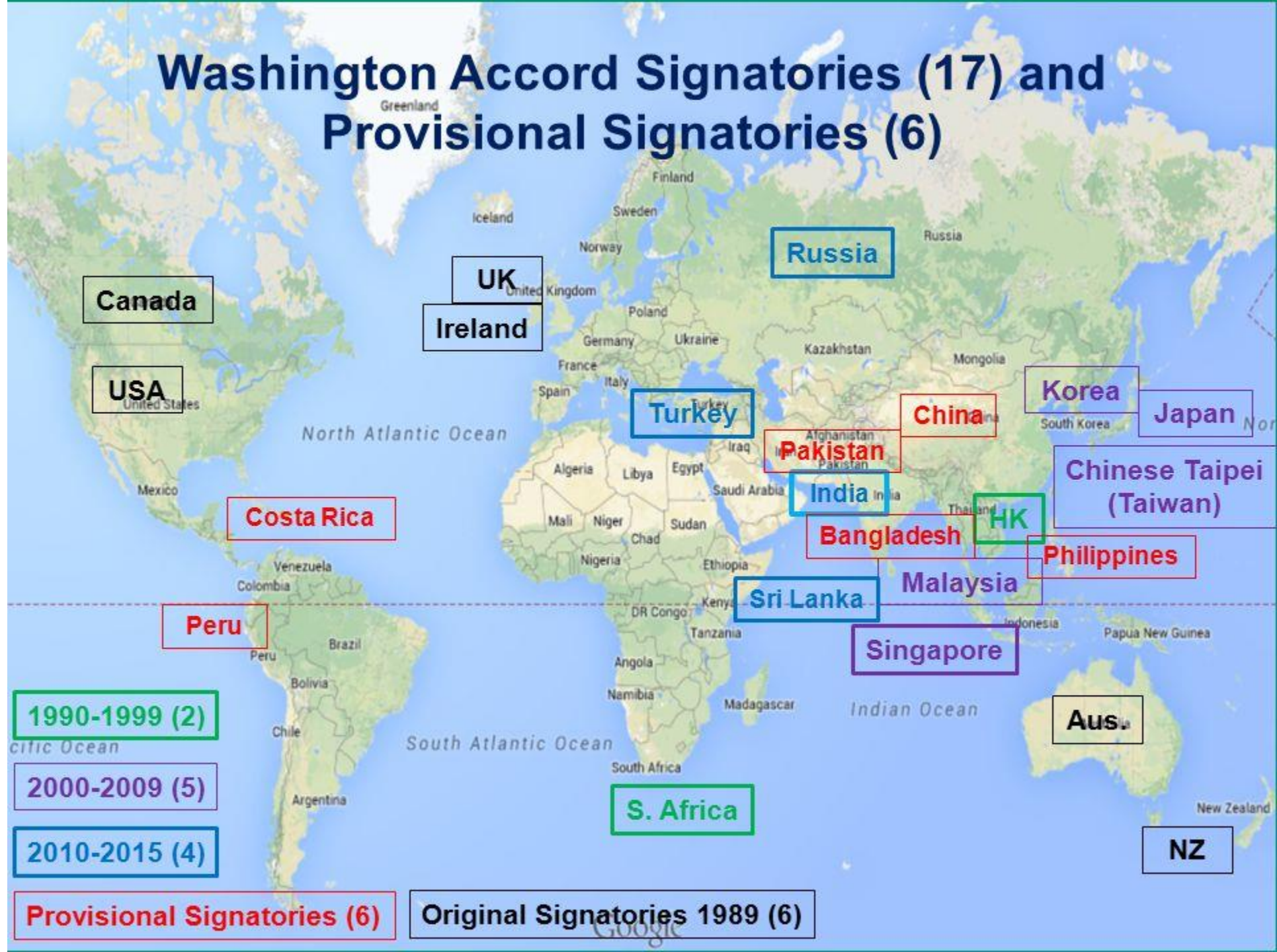
**At the end of this workshop, participants are expected to:**

1. Define and explain assessment and evaluation
2. Understand what to measure or assess
3. Compare and contrast different assessment tools
4. How to assess main graduates' attributes

# OUTLINE OF THE WORKSHOP

1. Definition of Assessment and Evaluation
2. Overview of different assessment tools
3. How to assess main graduates' attributes

# Washington Accord Signatories (17) and Provisional Signatories (6)



1990-1999 (2)

2000-2009 (5)

2010-2015 (4)

Provisional Signatories (6)

Original Signatories 1989 (6)

## **ASSESSMENT:**

Processes that identify, collect, use and prepare data for evaluation of achievement of programme outcomes or programme educational objectives.

## **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.

# Assessment

- drives learning (necessary evil!)
- is formative or/and summative; to demonstrate student's competence in demonstrating a specific outcome
- is the process that identify, collect, use and prepare data that can **be used to evaluate** attainment.

# What to Assess/Measure?

- Delivery Method
- Lecturer's Attribute
- Learning Environment
- Assessing Student/Cohort (Course Outcome)
- Assessing Student/Cohort (Programme Outcome)

# Assessment tools

- Exit surveys, Exit interviews (P)
- Alumni surveys and interviews (P)
- Employer surveys and interviews (P)
- Job offers, starting salaries (relative to national benchmark) (P)
- Admission to graduate schools (P)
- Performance in group and internship assignments and in PBL situation (P,C)
- Assignments, report and tests in capstone design course (P,C)
- Standardized tests (P,C)

P: programme C: Course

## Assessment tools cont....

- Student surveys, individual and focus group interviews (P,C)
- Peer-evaluations, self evaluations (P,C)
- Student portfolios (P,C)
- Behavioral observation (P,C)
- Written tests linked to learning objectives (C)
- Written project reports (C)
- Oral presentation, live or videotape (C)
- Research proposals, student-formulated problems (C)
- Classrooms assessment Techniques (C)

# **1: Engineering Knowledge: Application of scientific and engineering knowledge**

***Learning outcome:*** Demonstrate competence to apply knowledge of mathematics, basic science and engineering sciences from first principles to solve complex engineering problems

## ***Associated Assessment Criteria***

The candidate:

- I. Brings mathematical, numerical analysis and statistical knowledge and methods to bear on engineering problems by using an appropriate mix of:
  - a) Formal analysis and modelling of engineering components, systems or processes;
  - b) Communicating concepts, ideas and theories with the aid of mathematics;
  - c) Reasoning about and conceptualizing engineering components, systems or processes using mathematical concepts;
  - d) Dealing with uncertainty and risk through the use of probability and statistics.

2. Uses physical laws and knowledge of the physical world as a foundation for the engineering sciences and the solution of engineering problems by an appropriate mix of:

- a) Formal analysis and modelling of engineering components, systems or processes using principles and knowledge of the basic sciences;
- b) Reasoning about and conceptualizing engineering problems, components, systems or processes using principles of the basic sciences.

3. Uses the techniques, principles and laws of engineering science at a fundamental level and in at least one specialist area to:

- a) Identify and solve open-ended engineering problems;
- b) Identify and conduct engineering applications;
- c) Work across engineering disciplinary boundaries through cross disciplinary literacy and shared fundamental knowledge.

***Range Statement:***

Knowledge is coherent and systematically organized, covering the fundamentals of the discipline, with depth in limited specialist area(s), informed by current developments.

A coherent and critical understanding of fundamental principles and theories of a *discipline* is required. Understanding of emerging issues in specialist area(s). Application of knowledge requires recognition of boundaries and limitations of disciplines.

Note: Problems used for assessment may provide evidence in the application of one, two or all three categories of knowledge listed above.

## 2. Problem Analysis

**Learning outcome:** Demonstrate competence to identify, assess, formulate and solve *convergent* and *divergent* engineering problems creatively and innovatively.

### **Associated Assessment Criteria**

The candidate applies in a number of varied instances, a systematic problem solving method including:

1. Analyses and defines the problem, identifies the criteria for an acceptable solution;
2. Identifies necessary information and applicable engineering and other knowledge and skills;
3. Generates and formulates possible approaches to solution of problem;
4. Models and analyses possible solution(s);
5. Evaluates possible solutions and selects best solution;
6. Formulates and presents the solution in an appropriate form.

***Range Statement:***

Problems requires identification and analysis. Some cases occur in unfamiliar contexts. Problems are both *concrete* and *abstract* and may involve uncertainty.

Solutions are based on theory and evidence, together with judgement where necessary.

### **3: Design/Development of Solutions**

*Learning outcome:* Demonstrate competence to perform creative, *procedural* and *non-procedural* design and synthesis of components, systems, engineering works, products or processes.

#### *Associated Assessment Criteria:*

The candidate executes an acceptable design process encompassing the following:

1. Identifies and formulates the design problem to satisfy user needs, applicable standards, codes of practice and legislation;
2. Plans and manages the design process: focusses on important. issues, recognizes and deals with constraints;
3. Acquires and evaluates the requisite knowledge, information and resources: applies correct principles, evaluates and uses design tools;
4. Performs design tasks including analysis, quantitative modelling and optimization;

5. Evaluates alternatives and preferred solution: exercises judgment, tests implementability and performs techno-economic analyses;
6. Assesses impacts and benefits of the design: social, legal, health, safety, and environmental;
7. Communicates the design logic and information.

***Range Statement:*** A major design problem should be used to provide evidence. The problem would be typical of that which the graduate would participate in a typical employment situation shortly after graduation. The selection of components, systems, engineering works, products or processes to be designed is dependent on the discipline.

#### **4: Investigation:**

*Learning outcome:* Demonstrate competence to design and conduct investigations and experiments 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.

#### *Associated Assessment Criteria:*

The candidate executes an acceptable process including but not restricted to:

1. Plans and conducts investigations and experiments;
2. Conducts a literature search and critically evaluates material;
3. Performs necessary analyses;
4. Selects and uses appropriate equipment or software;
5. Analyses, interprets and derives information from data;
6. Draws conclusions based on evidence;
7. Communicates the purpose, process and outcomes in a technical report.

*Range Statement:* The balance of investigation and experiment should be appropriate to the discipline. An investigation or experimental study should be typical of those in which the graduate would participate in an employment situation shortly after graduation.

Note: An investigation differs from a design in that the objective is to produce knowledge and understanding of a phenomenon and a recommended course of action.

## 5: Modern Tool Usage:

*Learning outcome:* Demonstrate competence to 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.

*Associated Assessment Criteria:*

The candidate:

I. Uses method, skill or tool effectively by:

a) Selecting and assessing the applicability and limitations of the method, skill or tool;

b) Properly applying the method, skill or tool;

c) Critically testing and assessing the end-results produced by the method, skill or tool.

2. Creates computer applications as required by the discipline.

**Range Statement:** A range of methods, skills and tools appropriate to the disciplinary designation of the program including:

1. Discipline-specific tools, processes or procedures;
2. Computer packages for computation, modelling, simulation, and information handling;
3. Computers and networks and information infrastructures for accessing, processing, managing, and storing information to enhance personal productivity and teamwork;
4. Basic techniques from economics, business management, and health, safety and environmental protection.

## **6. The Engineer and Society:**

***Learning outcome:*** Demonstrate 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.

### ***Associated Assessment Criteria:***

The candidate exhibits professionalism by the following:

1. Being aware of requirements to maintain continued competence and to keep abreast of up-to-date tools and techniques;
2. Displays understanding of the system of professional development.
3. Accepts responsibility for own actions;
4. Displays judgment in decision making during problem solving and design;
5. Limits decision making to area of current competence;
6. Reason about and make judgment on ethical aspects in case study context;
7. Discerns boundaries of competence in problem solving and design.

***Range Statement:*** Evidence includes case studies typical of engineering practice situations in which the graduate is likely to participate.

## 7. Environment and Sustainability

***Learning outcome:*** Demonstrate *critical awareness* of the impact of professional engineering solutions in societal and environmental contexts and demonstrate knowledge of and need for sustainable development.

***Associated Assessment Criteria:***

The candidate identifies and deals with an appropriate combination of issues in:

1. The impact of technology on society;
2. Occupational and public health and safety;
3. Impacts on the physical environment;
4. The personal, social, cultural values and requirements of those affected by engineering activity.

***Range Statement:*** The combination of social, workplace (industrial) and physical environmental factor must be appropriate to the discipline or other designation of the qualification.

## 8. Ethics:

***Learning outcome:*** Demonstrate competence to apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice, including adherence to the COREN Engineers Code of Conduct.

***Associated Assessment Criteria:***

The candidate demonstrates effective application of ethical principles and commitment to professional practices by performing the following:

1. Identification and application of ethical principles related to engineering profession;
2. Commitment to professional ethics and norms of engineering practice;
3. Adherence to the COREN Engineers Code of Conduct;

## **9: Individual and Team Work:**

*Learning outcome:* Demonstrate competence to work effectively as an individual, and as a member or leader in diverse teams and in multi-disciplinary settings.

### ***Associated Assessment Criteria:***

The candidate demonstrates effective individual work by performing the following:

1. Identifies and focuses on objectives;
2. Works strategically;
3. Executes tasks effectively;
4. Delivers completed work on time.

The candidate demonstrates effective team work by the following:

1. Makes individual contribution to team activity;
2. Performs critical functions;
3. Enhances work of fellow team members;
4. Benefits from support of team members;
5. Communicates effectively with team members;
6. Delivers completed work on time.

The candidate demonstrates multidisciplinary work by the following:

1. Acquires a working knowledge of co-workers' discipline;
2. Uses a systems approach;
3. Communicates across disciplinary boundaries.

***Range Statement:*** Tasks require co-operation across at least one disciplinary boundary. Disciplines may be other engineering disciplines or be outside engineering.

## **10. Communication:**

*Learning outcome:* Demonstrate competence to 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.

### *Associated Assessment Criteria:*

The candidate executes effective written communication as evidenced by:

1. Uses appropriate structure, style and language for purpose and audience;
2. Uses effective graphical support;
3. Applies methods of providing information for use by others involved in engineering activity;
4. Meets the requirements of the target audience.

The candidate executes effective oral communication as evidenced by:

1. Uses appropriate structure, style and language;
2. Uses appropriate visual materials;
3. Delivers fluently;
4. Meets the requirements of the intended audience.

*Range Statement:* Material to be communicated is in an academic or simulated professional context. Audiences range from engineering peers, management and lay persons, using appropriate academic or professional discourse. Written reports range from short (300-1000 word plus tables diagrams) to long (10,000 to 15,000 words plus tables, diagrams and appendices), covering material at exit level. Methods of providing information include the conventional methods of the discipline, for example engineering drawings, as well as subject-specific methods.

## **10. Project Management:**

***Learning outcome:*** Demonstrate competence in 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.

### ***Associated Assessment Criteria:***

The candidate demonstrates effective project management by performing the following:

1. Identifies and focuses on knowledge and understanding of engineering, management and financial principles ;
2. Apply the knowledge of engineering management and financial principles individually and as a member of a team;
3. Manage project in a multi-disciplinary environments;
4. Delivers completed work on time.

## **12: Lifelong Learning**

***Learning outcome:*** Demonstrate competence to 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.

### ***Associated Assessment Criteria:***

The candidate shows evidence of being an effective independent learner by the following:

1. Reflects on own learning and determines learning requirements and strategies;
2. Sources and evaluates information;
3. Accesses, comprehends and applies knowledge acquired outside formal instruction;
4. Critically challenges assumptions and embraces new thinking.

***Range Statement:*** Operate independently in complex, ill-defined contexts requiring personal responsibility and initiative, accurately self-evaluate and take responsibility for learning requirements; be aware of social and ethical implications of applying knowledge in particular contexts.

# SUMMARY

1. Assessment is an essential part of the OBE Implementations
2. There different assessment methods for different aspects of learning process
3. What get measured get managed
4. Evaluation is necessary to determine level of attainment of graduate attributes