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An Overview of Washington Accord Requirements

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Presentation Outline

- Washington Accord: an Introduction
- Graduate Attributes
- Knowledge Profiles
- Complex Engineering Problems and Complex Engineering Activities
- Professional Competences
- Conclusion

Washington Accord: an Introduction

- It is a multi-lateral agreement originally signed in 1989 between bodies responsible for accreditation or recognition of tertiary-level engineering qualifications within their jurisdictions who have chosen to work collectively to assist the mobility of professional engineers.

- Together with other accords (i.e., the Sydney Accord signed in 2001 the Dublin accord signed in 2002), the signatories are committed to development and recognition of good practice in engineering education.

- Up to date, there are twenty-one (21) full signatories (or, countries) and seven (7) provisional signatories.

Development Stages of an Engineering Professional

The graduate stage:

Upon attainment of an accredited educational qualification;

Equipped with a knowledge base and attributes to continue learning.

Professional Registration:

Following a period of formative development under supervision of an engineering practitioner;

Progresses from an assisting role to taking more individual and team responsibility.

International Registration:

Once registered as a professional, the practitioner must maintain and expand competence.

To qualify for international register held by the various jurisdictions under the accords.

Washington, Sydney and Dublin Accords

Washington Accord

For academic programs dealing with the practice of ENGINEERING at the professional level

Range qualifier used in attribute statements: COMPLEX engineering problems

Sydney Accord

For academic programs dealing with ENGINEERING TECHNOLOGY

Range qualifier used in attribute statements: BROADLY-DEFINED engineering problems

Dublin Accord

For academic programs that underpin the educational base for ENGINEERING TECHNICIANS

Range qualifier used in attribute statements: WELL-DEFINED engineering problems

Source: ieagreements.org

Referenced Documents

INTERNATIONAL ENGINEERING ALLIANCE

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.

Executive Summary

Several accrediting bodies for engineering qualifications have developed outcomes-based criteria for evaluating programmes. Similarly, a number of engineering regulatory bodies have developed or are in the process of developing competency-based standards for registration. Educational and professional accords for mutual recognition of qualifications and registration have developed statements of graduate attributes and professional competency profiles. This document presents the background to these developments, their purpose and the methodology and limitations of the statements. After defining general range statements that allow the competencies of the different categories to be distinguished, the paper presents the graduate attributes and professional competency profiles for three professional tracks: engineer, engineering technologist and engineering technician.

INTERNATIONAL ENGINEERING ALLIANCE

IEA Constituent Agreements

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

Graduate Attributes and Professional Competences

Approved Version 4: 21 June 2021

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Executive Summary

Many accrediting bodies for engineering qualifications have developed outcomes-based criteria for evaluating programs. Similarly, many engineering regulatory bodies have developed or are in the process of developing competence-based standards for registration. Educational and professional accords for mutual recognition of qualifications and registration have developed statements of graduate attributes and professional competence profiles. This document, which is a revised version that takes into account the present-day state of engineering activities, presents the background to these developments, their purpose, and the methodology and limitations of the statements. After defining general range statements that allow the competences of the different categories to be distinguished, the paper presents the graduate attributes and professional competence profiles for three professional tracks: engineer, engineering technologist, and engineering technician.

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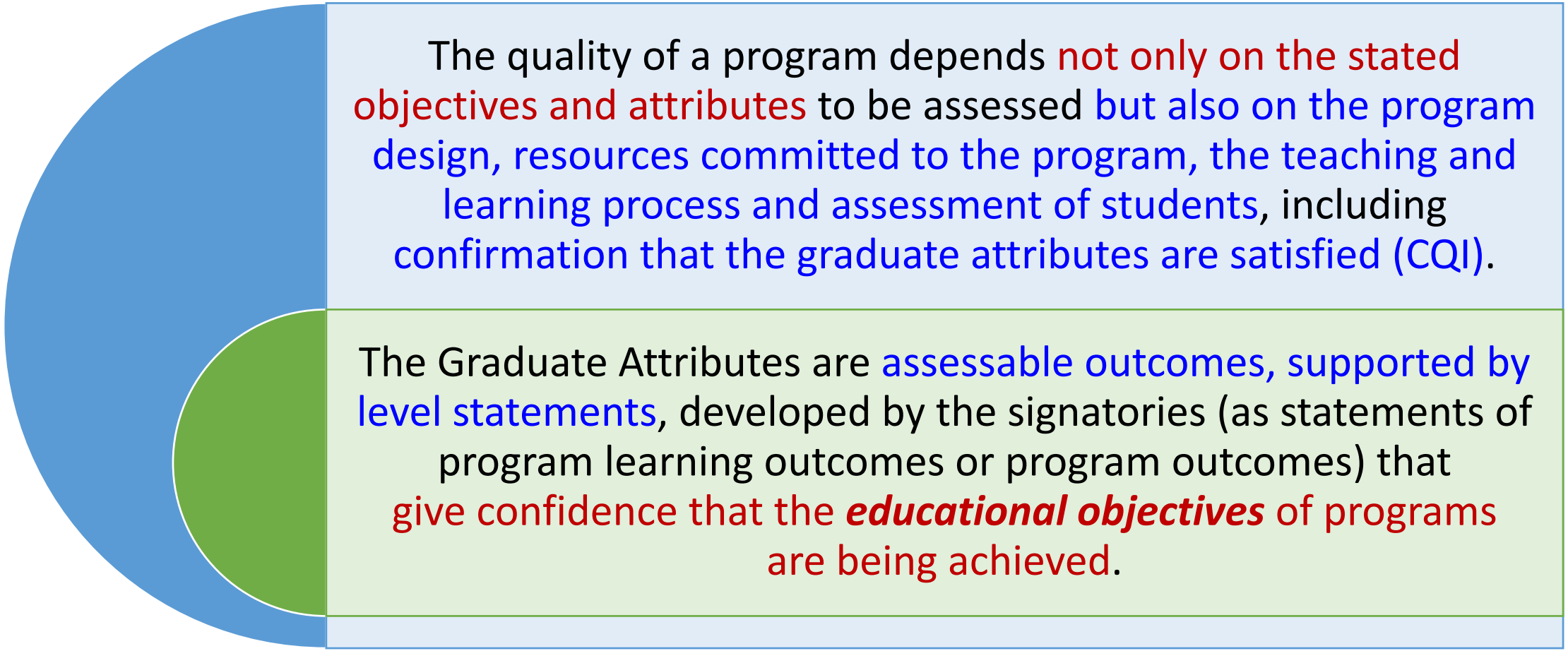
SUSTAINABLE DEVELOPMENT GOALS

Graduates Attributes

- form a set of ***individually assessable*** *outcomes* that are the components indicative of the graduate's potential to acquire competence to practise at the appropriate level.
- are exemplars of the attributes expected of graduate from an accredited program, composed of clear, succinct statements of the expected capability.
- serve to identify distinctive characteristics as well as areas of commonality between the expected outcomes of different types of programs.

- do not, in themselves, constitute an "international standard" for accredited qualifications but provide a widely accepted common point of reference or benchmark for bodies to describe the outcomes of substantially equivalent qualifications.

Graduate Attributes and Quality of Programs



Graduate Attribute: Version 2013 vs. 2021

Differentiating Characteristic	Version 2013
Engineering Knowledge:	**WA1:** Apply knowledge of mathematics, natural science, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to the solution of complex engineering problems.
Problem Analysis: Complexity of analysis	**WA2:** Identify, formulate, research literature and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences. (WK1 to WK4)

Differentiating Characteristic	Version 2021
Engineering Knowledge: Breadth, depth and type of knowledge, both theoretical and practical	**WA1:** Apply knowledge of mathematics, natural science, computing and engineering fundamentals, and an engineering specialization as specified in WK1 to WK4 respectively to develop solutions to complex engineering problems.
Problem Analysis: Complexity of analysis	**WA2:** Identify, formulate, research literature and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences with holistic considerations for sustainable development*. (WK1 to WK4)

*Represented by the 17 UN Sustainable Development Goals (UN-SDG)

Graduate Attribute: Version 2013 vs. 2021

Differentiating Characteristic	Version 2013
Design/ Development of Solutions: 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	**WA3:** Design solutions for 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. (WK5)
Investigation: Breadth and depth of investigation and experimentation	WA4: Conduct investigations of complex problems using research-based knowledge (WK8) and research methods including design of experiments, analysis and interpretation of data, and synthesis of information to provide valid conclusions.

Differentiating Characteristic	Version 2021
Design/ Development of Solutions: Breadth and uniqueness of engineering problems, i.e., the extent to which problems are original and to which solutions have not previously been identified or codified	**WA3:** Design creative solutions for complex engineering problems and design systems, components or processes to meet identified needs with appropriate consideration for public health and safety, whole-life cost, net zero carbon as well as resource, cultural, societal, and environmental considerations as required. (WK5)
Investigation: Breadth and depth of investigation and experimentation	**WA4:** Conduct investigations of complex engineering problems using research methods including research-based knowledge, design of experiments, analysis and interpretation of data, and synthesis of information to provide valid conclusions. (WK8)

Graduate Attribute: Version 2013 vs. 2021

Differentiating Characteristic	Version 2013
Modern Tool Usage: Level of understanding of the appropriateness of the tool	**WA5:** Create, select and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modelling, to complex engineering problems, with an understanding of the limitations. (WK6)
The Engineer and Society: Level of knowledge and responsibility	**WA6:** Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice and solutions to complex engineering problems. (WK7)

Differentiating Characteristic	Version 2021
Tool Usage: Level of understanding of the appropriateness of technologies and tools	**WA5:** Create, select and apply, and recognize limitations of appropriate techniques, resources, and modern engineering and IT tools, including prediction and modelling, to complex engineering problems. (WK2 and WK6)
The Engineer and the World: Level of knowledge and responsibility for sustainable development	**WA6:** When solving complex engineering problems, analyze and evaluate sustainable development impacts* to: society, the economy, sustainability, health and safety, legal frameworks, and the environment. (WK1, WK5, and WK7)

*Represented by the 17 UN Sustainable Development Goals (UN-SDG)

Graduate Attribute: Version 2013 vs. 2021

Differentiating Characteristic	Version 2013	Differentiating Characteristic	Version 2021
Environment and Sustain-ability: Type of solutions.	**WA7**: Understand and evaluate the sustainability and impact of professional engineering work in the solution of complex engineering problems in societal and environmental contexts. (WK7)	-	-
Ethics: Understanding and level of practice	**WA8**: Apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice. (WK7)	**Ethics:** Understanding and level of practice	**WA7:** Apply ethical principles and commit to professional ethics and norms of engineering practice and adhere to relevant national and international laws. Demonstrate an understanding of the need for diversity and inclusion. (WK9)
Individual and Team work: Role in and diversity of team	**WA9:** Function effectively as an individual, and as a member or leader in diverse teams and in multi-disciplinary settings.	**Individual and Collaborative Team work:** Role in and diversity of team	**WA8:** Function effectively as an individual, and as a member or leader in diverse and inclusive teams and in multi-disciplinary, face-to-face, remote and distributed settings. (WK9)

Graduate Attribute: Version 2013 vs. 2021

Differentiating Characteristic	Version 2013
Communication: Level of communication according to type of activities performed	**WA10**: Communicate effectively on 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.
Project Management and Finance: Level of management required for differing types of activity	**WA11**: Demonstrate knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

Differentiating Characteristic	Version 2021
Communication: Level of communication according to type of activities performed	**WA9:** Communicate effectively and inclusively on 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, taking into account cultural, language, and learning differences.
Project Management and Finance: Level of management required for differing types of activity	**WA10:** Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.

Graduate Attribute: Version 2013 vs. 2021

Differentiating Characteristic	Version 2013	Differentiating Characteristic	Version 2021
Lifelong learning: Preparation for and depth of continuing learning	**WA12**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	**Lifelong learning:** Duration and manner	**WA11:** Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change (WK8)

Knowledge Profile

- is an indicated volume of learning and the attributes against which graduates must be able to perform (i.e., the framework for program's body of knowledge or curriculum structure).
- is a requirement for designing programs with different detailed structures, learning pathways and modes of delivery.
  - Evaluation of these individual programs is the concern of national accreditation systems.

Graduate Attribute: Version 2013 vs. 2021

Version 2013	Version 2021
WK1: A systematic, theory-based understanding of the **natural sciences** applicable to the discipline.	**WK1:** A systematic, theory-based understanding of the **natural sciences** applicable to the discipline and awareness of relevant **social sciences**.
WK2: Conceptually-based **mathematics**, numerical analysis, statistics and formal aspects of computer and information science to support analysis and modelling applicable to the discipline.	**WK2:** Conceptually-based **mathematics**, numerical analysis, data analysis, statistics and formal aspects of computer and information science to support detailed analysis and modelling applicable to the discipline.
WK3: A systematic, theory-based formulation of **engineering fundamentals** required in the engineering discipline.	**WK3:** A systematic, theory-based formulation of **engineering fundamentals** required in the engineering discipline.
WK4: Engineering **specialist knowledge** that provides theoretical frameworks and bodies of knowledge for the accepted practice areas in the engineering discipline; much is at the forefront of the discipline.	**WK4:** Engineering **specialist knowledge** that provides theoretical frameworks and bodies of knowledge for the accepted practice areas in the engineering discipline; much is at the forefront of the discipline.

Graduate Attribute: Version 2013 vs. 2021

Version 2013	Version 2021
WK5: Knowledge that supports **engineering design** in a practice area.	**WK5:** Knowledge, including efficient resource use, environmental impacts, whole-life cost, re-use of resources, net zero carbon, and similar concepts, that supports **engineering design and operations** in a practice area.
WK6: Knowledge of **engineering practice** (technology) in the practice areas in the engineering discipline.	**WK6:** Knowledge of **engineering practice** (technology) in the practice areas in the engineering discipline.
WK7: **Comprehension** of the role of engineering in society and identified issues in engineering practice in the discipline: ethics and the professional responsibility of an engineer to public safety; the impacts of engineering activity: economic, social, cultural, environmental and sustainability.	**WK7: Knowledge** of the role of engineering in society and identified issues in engineering practice in the discipline, such as the professional responsibility of an engineer to public safety and sustainable development*.
WK8: Engagement with selected knowledge in the **research literature** of the discipline.	**WK8:** Engagement with selected knowledge in the current **research literature** of the discipline, awareness of the power of critical thinking and creative approaches to evaluate emerging issues.

*Represented by the 17 UN Sustainable Development Goals (UN-SDG)

Graduate Attribute: Version 2013 vs. 2021

Version 2013	Version 2021
-	**WK9: Ethics, inclusive behavior and conduct.** Knowledge of professional ethics, responsibilities, and norms of engineering practice. Awareness of the need for diversity by reason of ethnicity, gender, age, physical ability etc. with mutual understanding and respect, and of inclusive attitudes.
A programme that builds this type of knowledge and develops the attributes listed below is typically achieved in 4 to 5 years of study, depending on the level of students at entry.	A program that builds this type of knowledge and attitude and develops the base attributes listed below is typically achieved in 4 to 5 years of study, depending on the level of students at entry.

Complex Engineering Problems (CPS)

Attributes	Version 2013	Version 2021
Depth of Knowledge Required	**WP1**: Cannot be resolved without in-depth engineering knowledge at the level of one or more of WK3, WK4, WK5, WK6 or WK8 which allows a fundamentals-based, first principles analytical approach.	**WP1:** Cannot be resolved without in-depth engineering knowledge at the level of one or more of WK3, WK4, WK5, WK6 or WK8 which allows a fundamentals- based, first principles analytical approach.
Range of conflicting requirements	**WP2**: Involve wide-ranging or conflicting technical, engineering and other issues.	**WP2:** Involve wide-ranging and/or conflicting technical, non-technical issues (such as ethical, sustainability, legal, political, economic, societal) and consideration of future requirements.
Depth of analysis required	**WP3**: Have no obvious solution and require abstract thinking, originality in analysis to formulate suitable models.	**WP3:** Have no obvious solution and require abstract thinking, creativity and originality in analysis to formulate suitable models.
Familiarity of issues	**WP4**: Involve infrequently encountered issues.	**WP4:** Involve infrequently encountered issues or novel problems.
Extent of applicable codes	**WP5**: Are outside problems encompassed by standards and codes of practice for professional engineering.	**WP5:** Address problems not encompassed by standards and codes of practice for professional engineering.

Complex Engineering Problems (CPS)

Attributes	Version 2013	Version 2021
Extent of stakeholder involvement and conflicting requirements	**WP6**: Involve diverse groups of stakeholders with widely varying needs.	**WP6:** Involve collaboration across engineering disciplines, other fields, and/or diverse groups of stakeholders with widely varying needs.
Interdependence	**WP7**: Are high level problems including many component parts or sub-problems.	**WP 7:** Address high level problems with many components or sub-problems that may require a systems approach.

Complex Engineering Activities (CEA)

Attributes	Version 2013	Version 2021
Complex activities means (*engineering*) activities or projects that have some or all of the following characteristics:		
Range of resources	**EA1**: Involve the use of diverse resources (and for this purpose resources includes people, money, equipment, materials, information and technologies).	**EA1:** Involve the use of diverse resources including people, data and information, natural, financial and physical resources and appropriate technologies including analytical and/or design software.
Level of interactions	**EA2**: Require resolution of significant problems arising from interactions between wide-ranging or conflicting technical, engineering or other issues.	**EA2:** Require optimal resolution of interactions between wide-ranging and/or conflicting technical, non-technical, and engineering issues.
Innovation	**EA3**: Involve creative use of engineering principles and research-based knowledge in novel ways.	**EA3:** Involve creative use of engineering principles, innovative solutions for a conscious purpose, and research-based knowledge.
Consequences to society and the environment	**EA4**: Have significant consequences in a range of contexts, characterized by difficulty of prediction and mitigation.	**EA4:** Have significant consequences in a range of contexts, characterized by difficulty of prediction and mitigation.
Familiarity	**EA5**: Can extend beyond previous experiences by applying principles-based approaches.	**EA5:** Can extend beyond previous experiences by applying principles-based approaches.

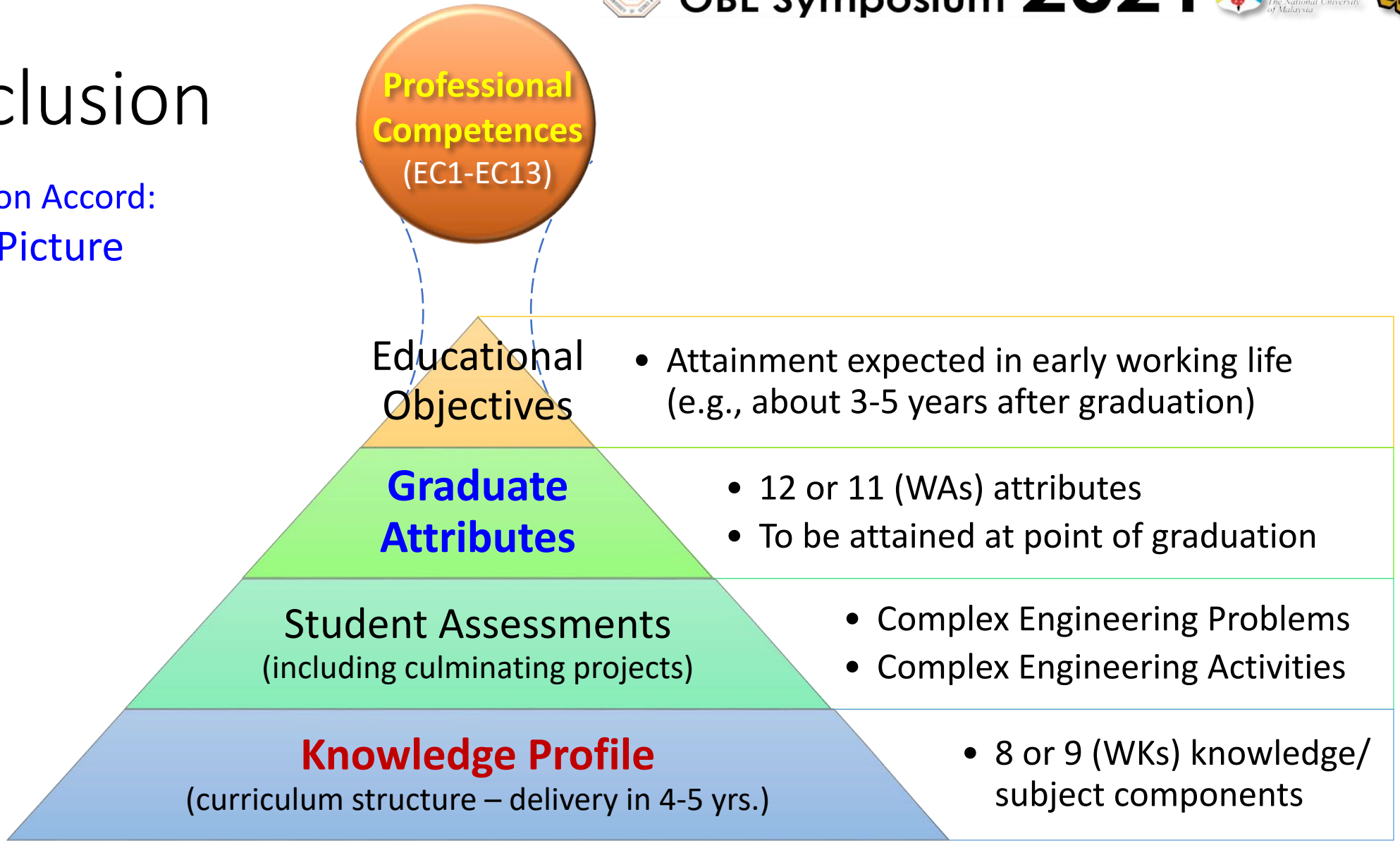
Professional Competences

- A professionally or occupationally competent person has the attributes necessary to perform the activities within the profession or occupation to the standards expected in independent employment or practice.
- It is expected to be able to demonstrate in a holistic way at the stage of attaining registration of a Professional Engineer.
- It can be described using a set of attributes (EC1-EC13) corresponding largely to the graduate attributes, but with different emphases.

- Unlike the graduate attributes, professional competence is more than a set of attributes that can be demonstrated individually and must be assessed holistically.

Conclusion

Washington Accord:
The Big Picture



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Thank you

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