Toward Global Recognition of Engineering Qualifications Accredited in Different Systems

Hu Hanrahan
University of the Witwatersrand, Johannesburg, South Africa
Hu.Hanrahan@wits.ac.za

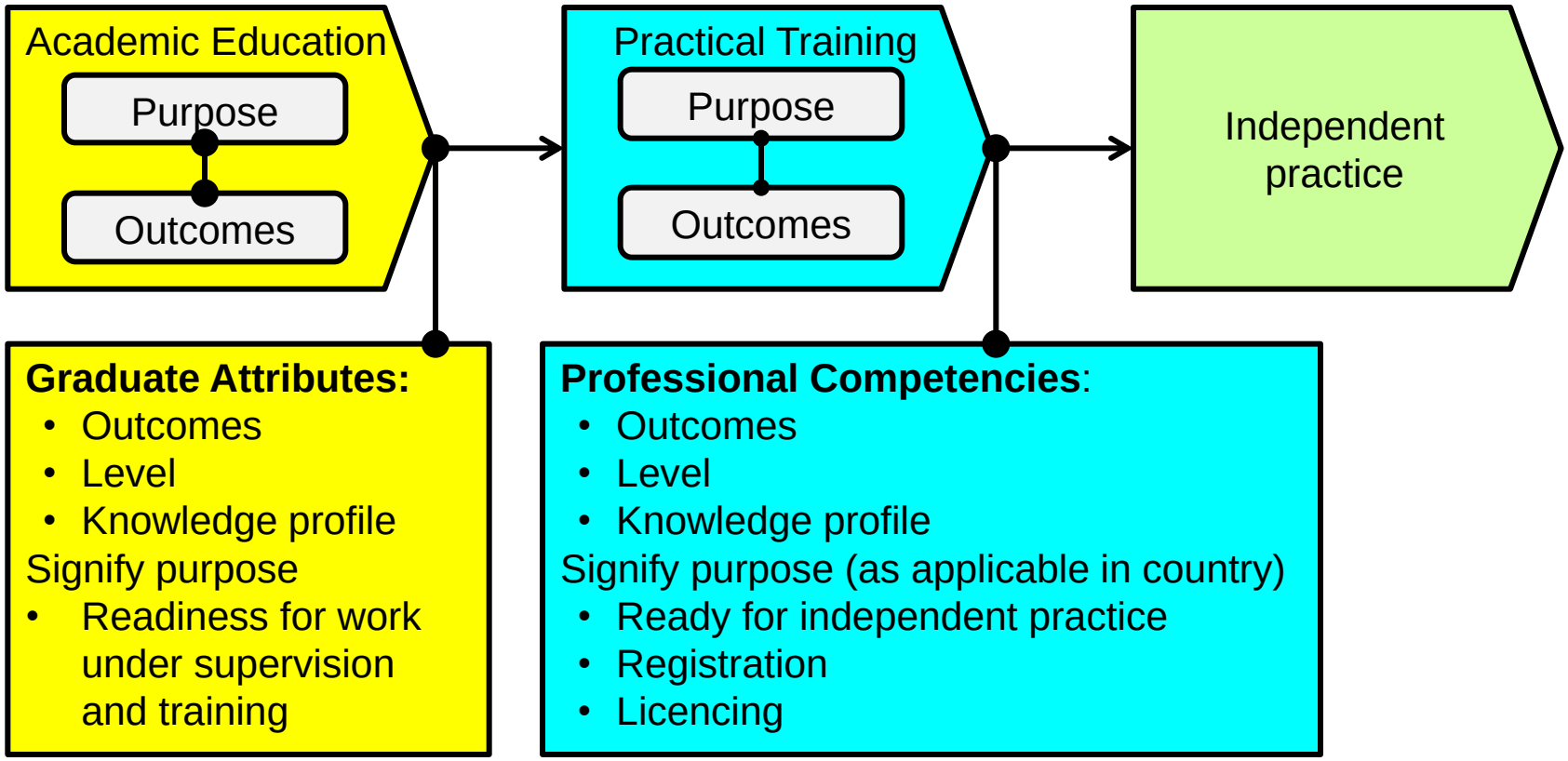
ENAEE Conference, Leuven, Belgium, September 2013

INTERNATIONAL ENGINEERING ALLIANCE

Outline

- Globalisation results in the provision of engineering services across national boundaries and movement of engineers
- Quality of engineering professional competence – and hence quality of engineering education – is a global concern
- Systems for standards and mutual recognition of engineering qualifications have emerged: IEA, EUR-ACE, …
- Recognition across such systems is logical progression
- How to work toward inter-system recognition without complexity
  - What Models?
  - What Principles?
  - What Common ground?

Reference Model for Professional Formation



- Diagram indicates components of professional formation systems
- Variants in different system, e.g. overlapped education and training

Comparison: Members and Information

IEA Education Accords	EUR-ACE System
Participants	
• Signatories: accrediting agencies operating within specific jurisdictions	• Authorised accrediting agencies
Public Documents	

• Graduate Attributes and Professional Competencies (V3)
• Rules and Procedures, incorporating best practice indicators for accreditation
  • To be separately published
	• EUR-ACE Framework Standards
	  • Section 2: Outcomes for accreditation
	  • Section 3: Guidelines for program assessment and accreditation
	  • Section 4: Procedures ..

Public Information: List/database	
• Accredited programs maintained by each signatory	• Labelled programs listed in EUR-ACE database

INTERNATIONAL ENGINEERING ALLIANCE

Comparison: Purpose, Standards, Processes

IEA Education Accords	EUR-ACE System
Professional Purpose	
Graduate Attributes & Professional Competencies defined for: • **Professional Engineer or equivalent** • **Engineering Technologist or equiv.** • **Engineering Technician or equiv.**	• **Accreditation is concerned with educational part of professional formation – no explicitly linkage to roles**
Standards	
• **Minimum standards set by each signatory: must be substantially equivalent to Accord exemplar**	• **EAFS program Outcomes for First and Second Cycle (and integrated) degrees**
Accreditation Processes	
• **Determined by signatories** • **Must be substantially equivalent to best practice**	• **Determined by EUR-ACE Framework Standards**

Comparison: Recognition Mechanism

IEA Education Accords	EUR-ACE System
Jurisdiction	
• Signatories generally but not exclusively evaluate and accredit programs in own territory	• Not restricted
Mutual Recognition	
• Signatories agree to recognise programs accredited in other signatory jurisdictions • With few well-defined exceptions, mutual recognition applies only to programs accredited in the home jurisdiction	• General intention is to support recognition of graduates • EUR-ACE Labelled programs are included in the Feani Index

Principles for Comparing Diverse Systems

1. Be clear on ***professional purpose*** of qualifications to be compared
   - Professional titles can confuse: use professional profiles in case of doubt
2. Base comparisons on ***standards achieved*** as a result of the accreditation process
   - Comparison of defined standards is a step in the process
3. ***Similar methods/models*** for defining standards, policies and procedures ease comparison
   - Outcomes-based graduate competence
4. …

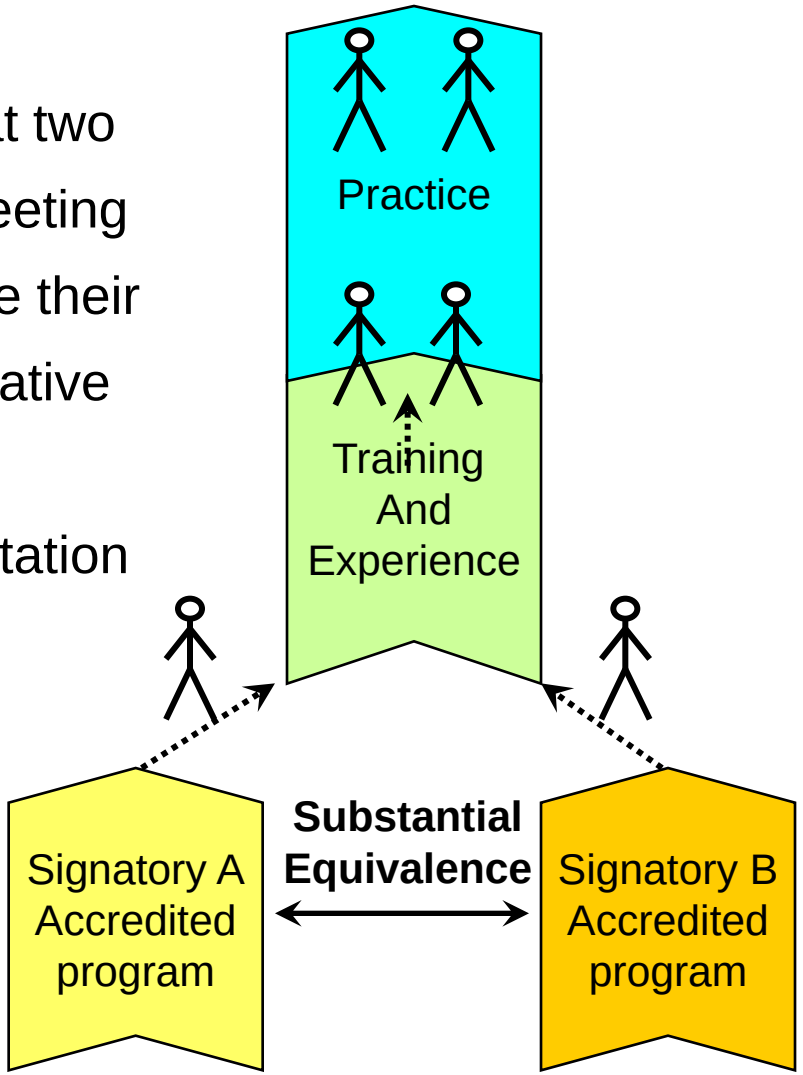
INTERNATIONAL ENGINEERING ALLIANCE

Principle 4: Substantial Equivalence

Substantial equivalence: means that two programs or systems, while not meeting a single set of criteria, both prepare their respective graduates to enter formative development toward professional competence with reasonable adaptation

Adapted from IEA Graduate Attributes and Professional Competencies

4. When standards or processes are not identical, use ***substantial equivalence*** as basis for comparison



INTERNATIONAL ENGINEERING ALLIANCE

Common Ground: Graduate Attributes: 1

- Three authorities on graduate competence:
  - IEA & EUR-ACE standards and
  - CDIO Syllabus - a program implementation guide

Attribute	IEA GA	EAFS	CDIO Syllabus
Apply knowledge: mathematics, natural science, engineering fundamentals and engineering specialization.	GA1	EA 1	1.1-1.3
Engineering Problem Analysis	GA2	EA 2	2.1
Engineering Design	GA 3	EA 3	4.3-4.6
Investigation	GA 4	EA 4.	2.2
Tools to support engineering activity	GA 5	EA 5	1.3

Common Ground: Graduate Attributes : 2

Attribute	IEA GA	EAFS	CDIO Syllabus
Societal, health, safety, cultural, legal issues	GA 6	EA 6	4.1
Environmental and sustainability issues	GA 7		4.1
Ethics and responsibilities of engineering practice	GA 8		2.5
Individual and team effectiveness	GA 9		3.1
Communication	GA 10		3.2
Engineering management	GA 11		4.2
Independent learning	GA 12		2.5.4

- There is substantial consensus on the twelve essential elements of graduate competence

Problem Solving Level 1

- Also agreement between range/level descriptors for engineering problem solving: **Washington Accord and EAFS SCD**

Washington Accord: Complex Engineering Problems have characteristic WP1 and some or all of WP2 to WP7:	Comparable Statement in EAFS SCD outcomes
WP1: Cannot be resolved without in-depth engineering knowledge at the level [defined in the WA Knowledge Profile] which allows a fundamentals-based, first principles analytical approach	Yes
WP2: Involve wide-ranging or conflicting technical, engineering and other issues	Yes
WP3: Have no obvious solution and require abstract thinking, originality in analysis to formulate suitable models	Yes
WP4: Involve infrequently encountered issues	Yes

Problem Solving Level 2

- Also agreement between range/level descriptors for engineering problem solving: **Sydney Accord and EAFS FCD**

Sydney Accord: Broadly-defined Engineering Problems have characteristic SP1 and some or all of SP2 to SP7:	Comparable Statement in EAFS FCD outcomes
SP1: Cannot be resolved without engineering knowledge at the level [defined in the SA Knowledge Profile] with a strong emphasis on the application of developed technology	Yes
SP2: Involve a variety of factors which may impose conflicting constraints	
SP3: Can be solved by application of well-proven analysis techniques	Yes
SP4: Belong to families of familiar problems which are solved in well-accepted ways	Yes

Conclusions

To avoid complexity in inter-system benchmarking and mutual recognition focus on the ultimate goal:

For similar professional purposes, is the ***quality achieved in action*** in each system substantially equivalent, thus avoiding need for low level matching?

- Are standards as defined, substantially equivalent?
- Do accreditation processes give cofindence that substantially equivalent graduate competence is attained?

INTERNATIONAL ENGINEERING ALLIANCE