Conceptual Model for Professional Competence and its Educational Foundation for Engineer and Engineering Technologist Roles

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Outline

1. Professional competence
2. Engineering roles
3. Competency model: contextual and conceptual dimensions
4. The educational level:
   - Washington and Sydney Accord Graduate Attributes
5. What changes from graduation to independent practice?
6. The Professional Level:
   - IEA Professional Competencies

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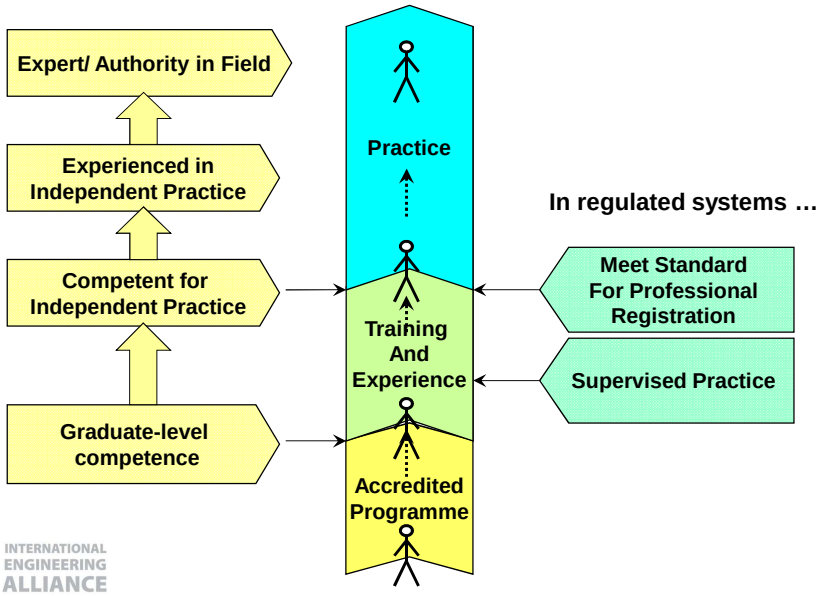
Context: Engineering Professional Lifecycle



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Varied engineering practice systems …

- National systems may have different levels:
  - No general regulation of engineering practice
  - Registration: Certification of competence and regulation of professional conduct
  - Licencing based on registration
- Common objectives are:
  - Effective engineering solutions
  - Protect public health and safety
  - Protect environment and sustainability
- Focus on fundamental rather than national system requirements

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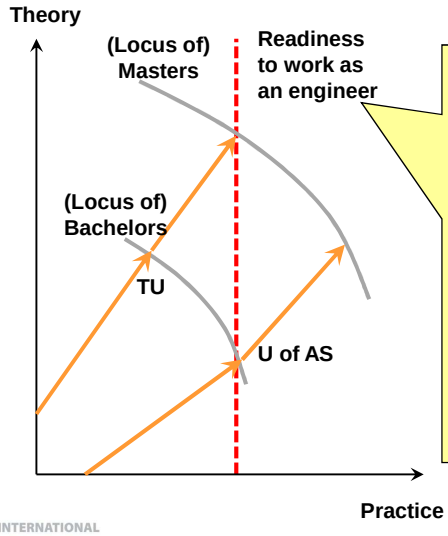
Pellegrini *et al* Degree Model



This is saying that:

- **Industry needs an entry level engineering graduate with a minimum practical knowledge**
- **Industry can absorb graduates with a wide range of theoretical ability**

It does not consider that:

- **Readiness to work is not necessarily readiness to take responsibility: that comes with further experience**
- **The trajectory of the two kinds of graduates a number of years after graduation**

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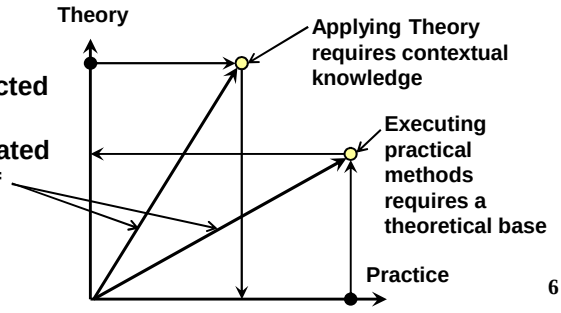
Competency model: contextual and conceptual dimensions

- **Conceptual or Theoretical:** codified, hierarchical theory moving to greater levels of abstraction and conceptual difficulty
- **Contextual or Practical:** methods connected to an application context, generally more segmented

In engineering, these dimensions are connected

The combination is related to the type and level of problem



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IEA: Graduate Attribute Overview

Knowledge-oriented

1: Using engineering knowledge

Defined Knowledge Profile

Problem-solving Skill Group

2: Problem analysis

3: Design/development of solutions

4: Investigations

Defined Level of Problem Solving

Skill-oriented Group

5: Modern Tool Usage

9: Individual and teamwork

10: Communication

11: Project/Engineering Management

Attitude-oriented Group

6: The Engineer in Society

7: Environment and Sustainability

8: Ethics

12: Life long learning

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See www.ieagreements.org

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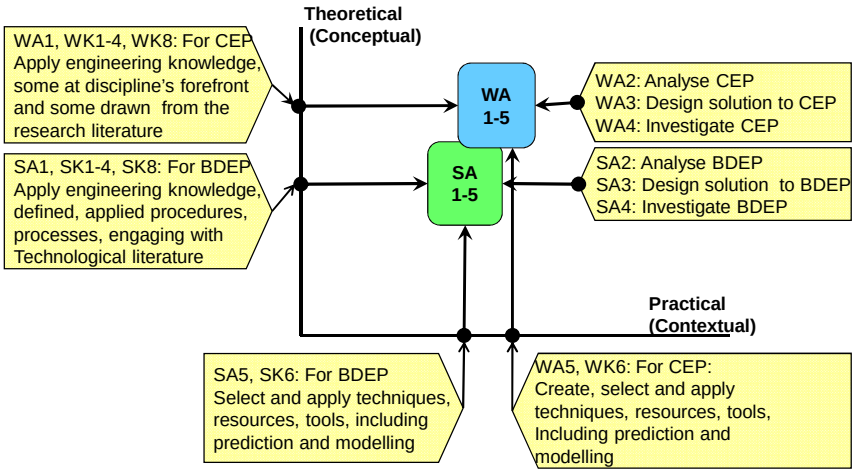
Conceptual-Contextual Components



WAn/SAn = Washington Sydney Accord Attribute n
WKn/SKn = Washington Sydney Accord Knowledge Profile n
CEP = Complex Engineering Problems
BDEP = Broadly-defined Engineering Problems

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Defining the Level

Knowledge Profile:
Statements of Level of:

1: Mathematics

2: Natural Science

3: Engineering Science

4: Engineering Speciality

5: Design

6: Engineering practice

7: Engineering in society

8: Research Knowledge

Graded for engineer, technologist and technician

Problem Solving:
Statements of Level of:

A: The difficulty of recognising and defining the problem

B: The difficulty of defining the required outcome

C: The complexity of the solution path

D: The engineering knowledge required

Graded for engineer, technologist and technician

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The IEA Professional Competencies

- The IEA Professional Competencies (PC) define the required competency of person who is able to practice independently, in a defined engineering role.
- The PC define the competency for:
  - Professional Engineer and similarly titled practitioners
  - Engineering Technologists and similarly titled practitioners
  - Engineering Technicians and similarly titled practitioners
- The PC are defined using:
  - 13 Outcomes
  - Level definition for engineering problem solving
  - Level definition for engineering activities

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How Engineering Competencies Develop?

Graduate Attributes	Professional Competencies
• Knowledge has a strong theoretical base with appreciation of context	• Knowledge becomes strongly contextual
• Problem solving focus on design and investigation	• Problem solving requirements supplemented by need to exercise judgement
• Understand and reason about issue, impacts and ethics	• Protect society, meet regulatory requirements • Act ethically • Take responsibility for actions
• Know and understanding engineering management	• Manage engineering activities

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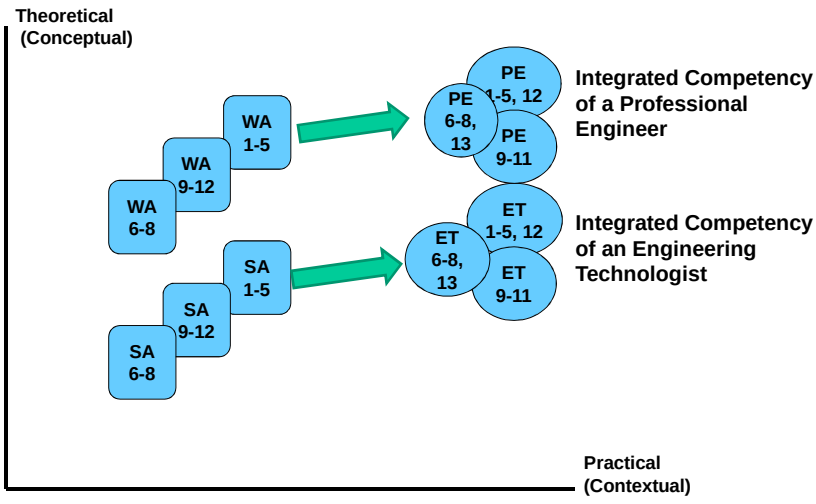
Visualising Development after Graduation



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Reflections

- Development of engineering professionals
  - Requires an educational base: the accredited degree
  - Achieving competence for-independent-practice
- IEA educational standards are informed by professional competence requirements
- Engineering roles are distinguished by definitions of level of:
  - Indications embedded in the outcomes
  - Problem solving
  - Knowledge profile

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