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Towards a Framework for Mapping Authentic Assessment to Competency in University Computing Education in the UK

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Competency-based Education

"CBE is defined as an outcome-based approach to education that incorporates modes of instructional delivery and assessment efforts designed to evaluate mastery of learning by students through their demonstration of the knowledge, attitudes, values, skills, and behaviours required for the degree sought."

Jennifer Gervais. 2016. The operational definition of competency-based education. J. Competency-Based Educ. 1, 2 (2016), 98–106. https://doi.org/10.1002/cbe2.1011 p99

There is more than one competency framework – two included in the paper.

- CC2020 Task Force. 2020. Computing Curricula 2020: Paradigms for Future Computing Curricula.
  - Developed by Academics in collaboration with Industrialists
- Skills for Information Age (SFIA:https://sfia-online.org/en)
  - An industrial framework
    - Perhaps of interest to education and training providers
  - Paper follows SFIA Version 8

Skills for Information Age(SFIA) Competency (1 of 2)

- *“Competency is applying the necessary knowledge and skill in a real-world environment with full professional responsibility and accountability for one's own actions.”*

The SFIA Foundation. 2021. Knowledge, skill and competency. https://sfia-online.org/en/about-sfia/about-sfia-appendices/knowledge-skill-and-competency

Skills for Information Age(SFIA) Competency (2 of 2)

- *"An individual should provide sufficient evidence that they have applied the relevant knowledge and skills, and have significant professional experience of performing the activities described by SFIA in a professional working environment through the performance of a role, job or function. They must consistently achieve expected objectives and a successful outcome on an ongoing basis, reliably at a professional level."*

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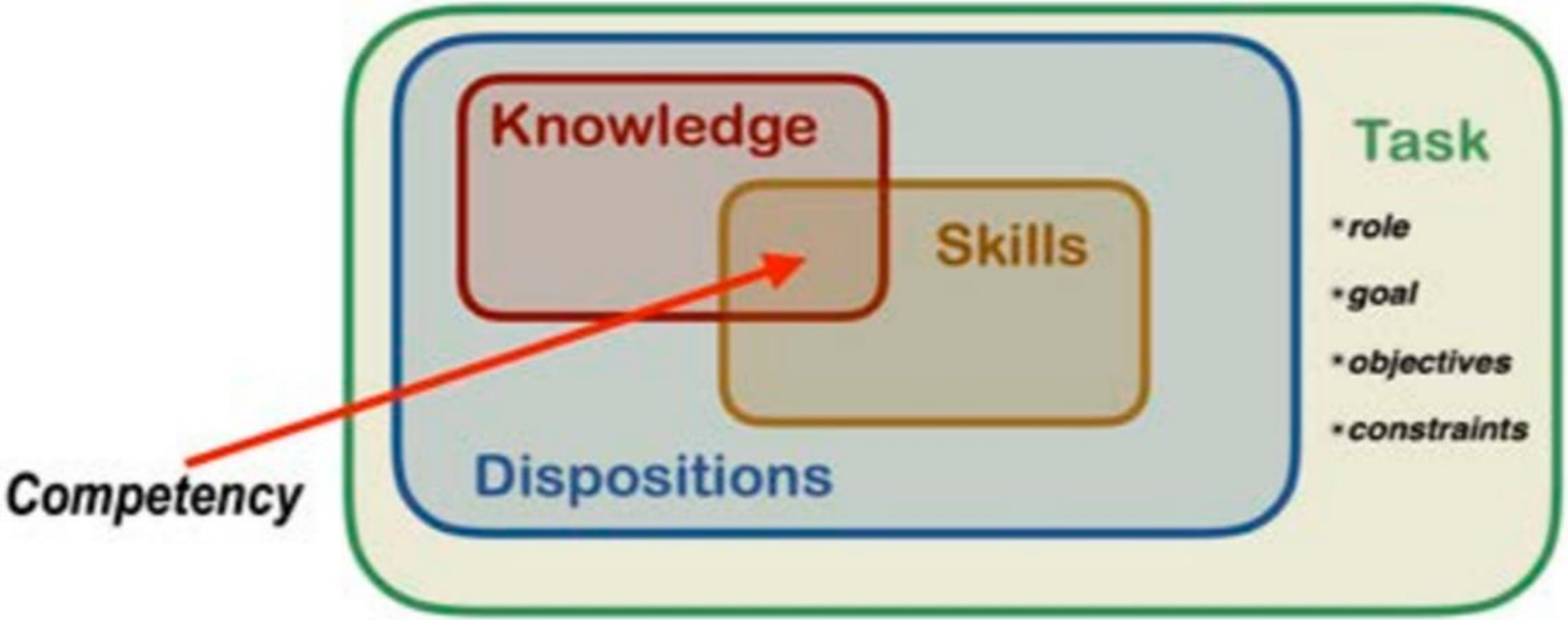
CC2020 Competency Model



Competency = [Knowledge + Skills + Dispositions] *in Task*

Knowledge is "know-what"

Skills is "know-how"

Dispositions are habitual inclinations that are socio-emotional tendencies, predilections, and attitudes

CC2020 Task Force. 2020. Computing Curricula 2020: Paradigms for Future Computing Curricula. Technical Report. ACM/IEEE/IEEE Computer Society. https://doi.org/10.1145/346796

Authentic Assessment

“engaging in worthy problems or questions of importance, in which students must use knowledge to fashion performances effectively and creatively. The tasks are either replicas of or analogous to the kinds of problems faced by adult citizens and consumers or professionals in the field”(Wiggins, 1993, p229)

G. P. Wiggins, Assessing student performance: Exploring the purpose and limits of testing. Jossey-Bass/Wiley, 1993, p229

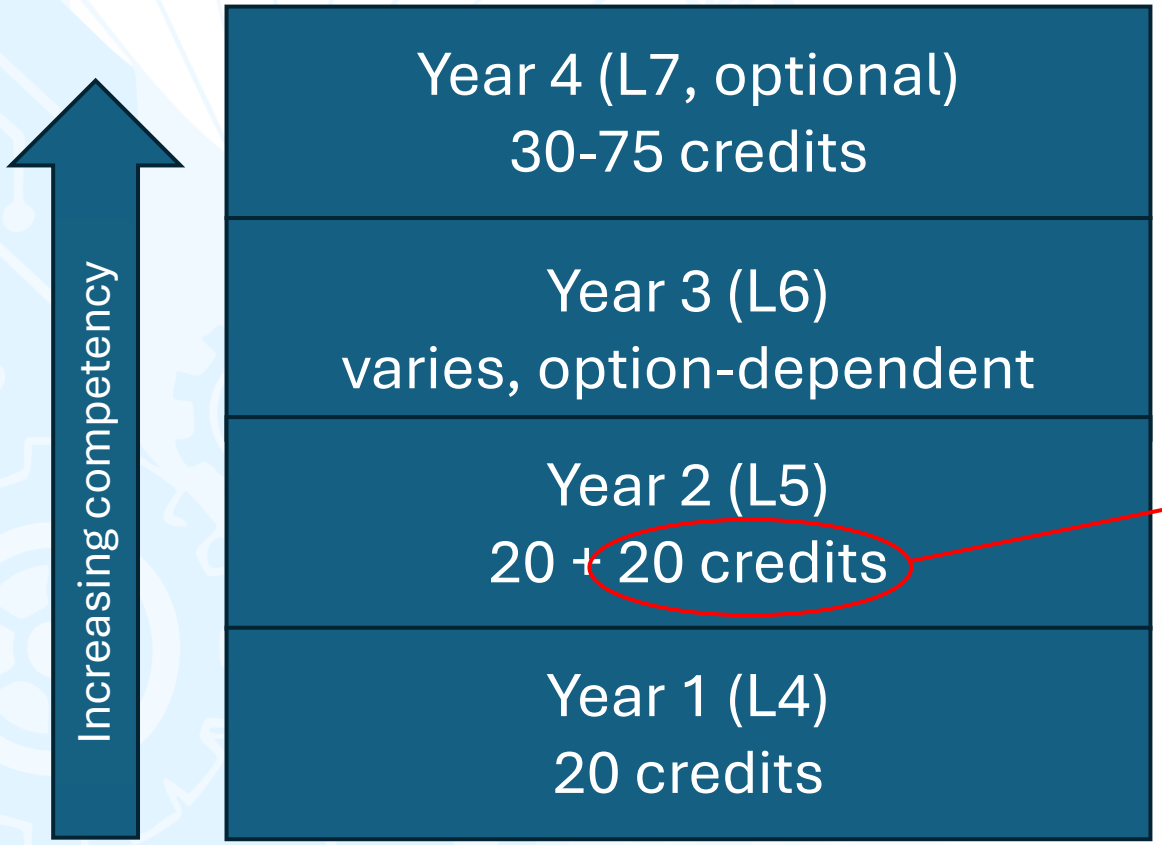
Method

- Proof-of-concept by evolutionary prototyping
- Derived framework based on
  - University context
  - Competency from
    - SFIA
    - CC2020
  - Existing authentic assessment frameworks (GRASPS, Five Dimensions, 8 Questions, Shultz Factors and Villarroel Components)
- Apply to two illustrative examples

The Framework

- Context
  - 1. General context, incl. university, programme and cohort size; 2. Curricula area; 3. Programme Learning Outcomes (PLOs); 4. Modules/courses involved
- SFIA Expectations
  - 1. SFIA Skill / Level; 2. SFIA Behaviour Attribute(s);3. The task involves real-world application; 4. The tasks enable evidence of successful repeated application
- ACM/IEEE Curricula expectations
  - 1. Skill; 2. Knowledge; 3. Disposition
- Authentic Assessment
  - Goal; Role; Audience; Situation; Product/Performance; Challenge; Reflective Practice: Is the task collaborative?

Software Engineering Example (1 of 2)



Context

- cohort ~ 300
- 120 credits/year
- Learning Outcome: "An understanding of software engineering, analysis and design methods and process management."

Authentic assessment

- Students work in agile teams with clients with real projects.
- Teams must gather requirements and develop a solution.
- Students are assessed on team processes and client interaction.

Software Engineering Example (2 of 2)

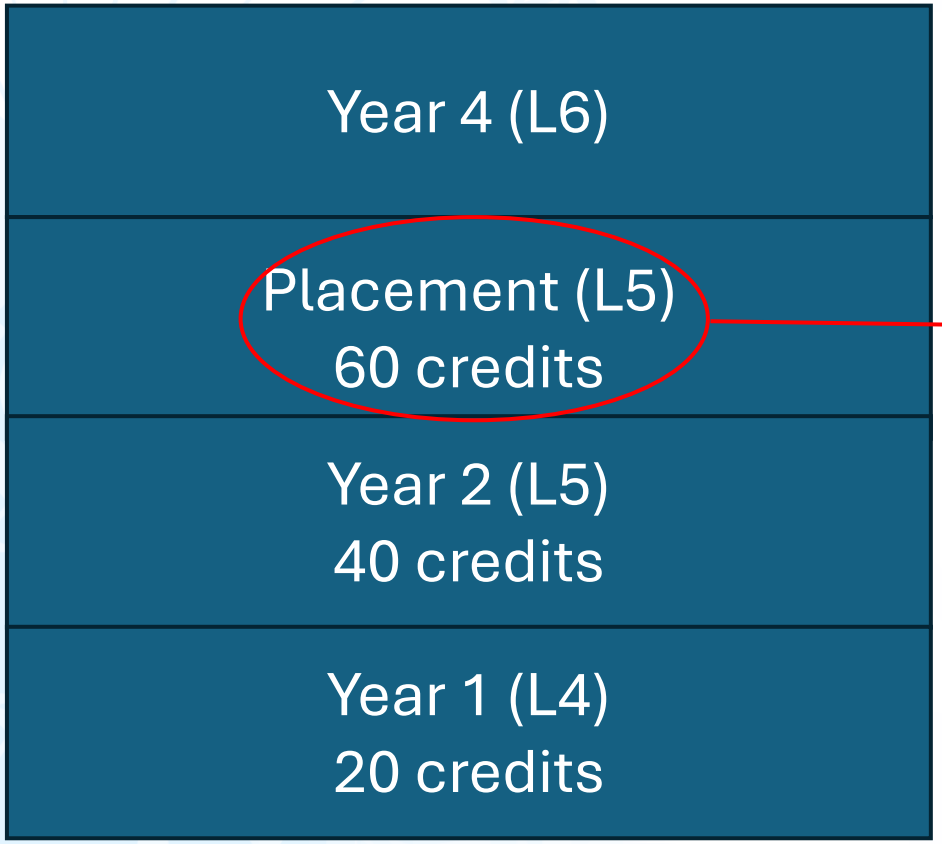
SFIA Expectations

- By the end of second-year, SE-related skills and behaviours developed to level 3+
- Real-world application: live project in second semester of second year

ACM/IEEE Curricula expectations

- Skills and knowledge related to software engineering develop over the first three semesters, then are consolidated in the live project in the fourth semester. Dispositions emerge during the live project.

Year-long Placement Example (1 of 2)



Context

- cohort ~ 200
- 60 credits/year
- assessment explicitly derived from programme and module level LOs

Authentic Assessment

- GRASPS analysis highlights value of
  - real-world situation,
  - focus on product / performance and purpose, in the context of a work-based challenge,
  - nurturing of critical reflection.

Year-long Placement Example (2 of 2)

SFIA Expectations

- all placement positions approved by academic staff to ensure SFIA skills coverage
- all SFIA generic attributes assessed, plus a range of SFIA behavioural factors.

ACM/IEEE Curricula expectations

- with Year 1 and 2 focusing on “knowledge”…
- … students on placement focus on the “skill” and “disposition” aspects of ACM competency.

Discussion, Conclusions and Further Work

- Both examples illustrate authentic assessment promoting competence development
- Competency is used in educational design
- Authentic Assessment is used in evidencing competency
- Framework is a candidate for further usage
- Next steps:
  - Further validation of framework
  - How widely used is authentic assessment?
  - Role of work-relevant, work-related and work-based learning in competency development?
  - How many competencies can degree programmes address?

Questions and Follow up

- We hope you have found today interesting.
- Please feel free to contact us with any questions or follow-up
- Got a good example? Please tell us!
- jhd@cs.bath.ac.uk

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  - Competency from
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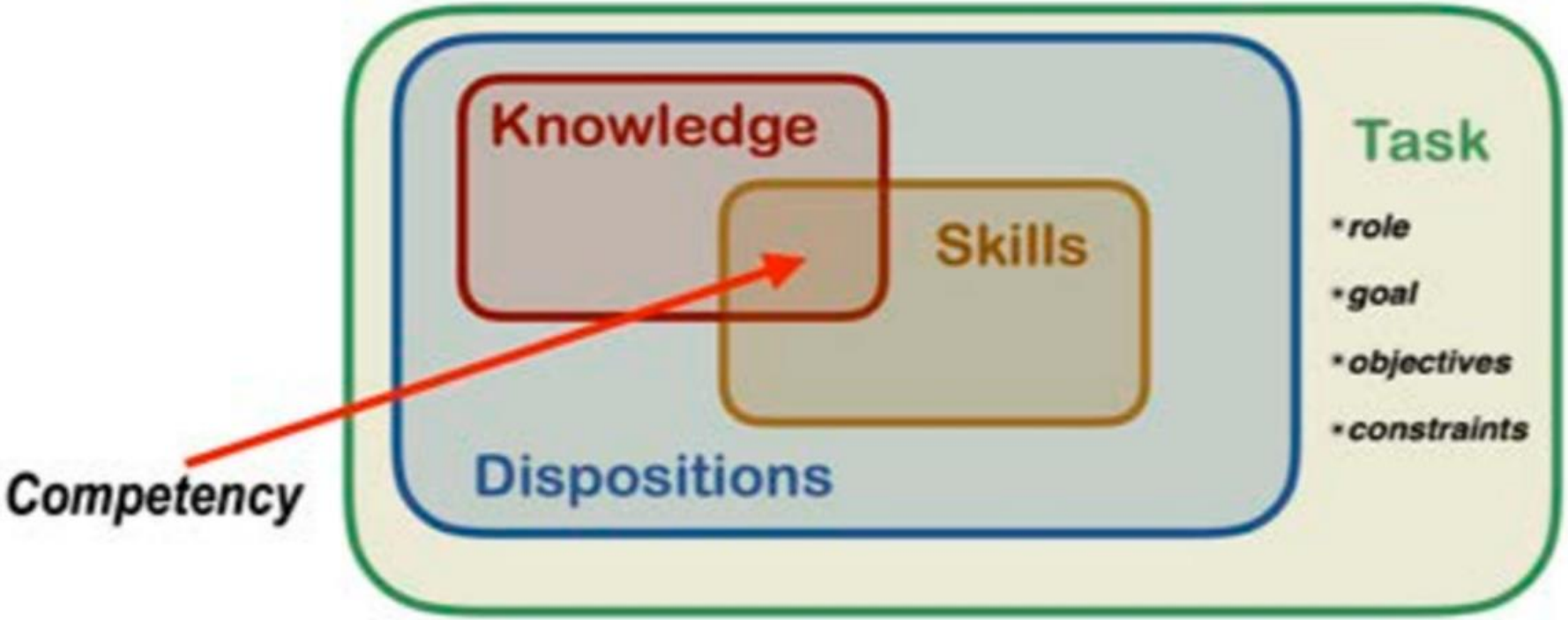
    - CC2020
  - Existing authentic assessment frameworks (GRASPS, Five Dimensions, 8 Questions, Shultz Factors and Villarroel Components)
- Apply to two illustrative examples

G. P. Wiggins and J. McTighe, “Understanding by Design.”
J. T. Gulikers, T. J. Bastiaens, and P. A. Kirschner, “A five-dimensional framework for authentic assessment,”
K. Ashford-Rowe, J. Herrington, and C. Brown, “Establishing the critical elements that determine authentic assessment,”
M. Schultz, K. Young, T. Gunning, and H. M.L., “Defining and measuring authentic assessment: a case study in the context of tertiary science,”
V. Villarroel, S. Bloxham, D. Bruna, B. C., and H.-S. C., “Authentic assessment: creating a blueprint for course design,”

CC2020 Competency Model



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Dispositions is "know-why"

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Software Engineering Example

Year 4 (L7, optional)
30-75 credits

Year 3 (L6)
varies, option-dependent

Year 2 (L5)
40 credits

Year 1 (L4)
20 credits

Context

- cohort ~ 300
- Three programmes with common core, shared PLO of "An understanding of software engineering, analysis and design methods and process management.

SFIA Expectations

- By the end of second-year, SE-related skills and behaviours developed to level 3+
- Real-world application: live project in second semester of second year

ACM/IEEE Curricula expectations

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Authentic Assessment

- Students work in agile teams with clients with real projects.
- Teams must work with clients to gather requirements and develop a solution.
- Students are assessed on team processes and client interaction.

Year-long Placement Example

Context

- cohort ~ 200
- assessment explicitly derived from programme and module level LOs
- assessment focus is achievement of competencies and critical reflection.

SFIA Expectations

- all placement positions approved by academic staff to ensure SFIA skills coverage
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ACM/IEEE Curricula expectations

- with Year 1 and 2 focusing on "knowledge"…
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Authentic Assessment

- GRASPS analysis highlights value of
  - real-world situation,
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  - and the nurturing of critical reflection.