Overview of the Computing Curricula CC2020 Report

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Presenter

Five decades of teaching experience
Published eighteen books
ACM editor-in-chief for nineteen years
Evaluator of eighty+ computing/engineering programs
Accreditation experience – more than thirty years
Chair of ACM Accreditation Committee – twelve years
Helped develop Estonia Accrediting Agency
IEEE Foundation board of director member
IEEE Fellow and Life Member
ACM Distinguished Educator
CSAB Fellow

Opinions expressed in this presentation are the result of the presenter's personal experiences and they do not reflect the endorsements of any other organization.
CC2020 Scope

Demographics
Number of Task Force members: 50
Number of continents represented: 6
Number of countries represented: 20
Number of women: 21; men: 29
Task force co-chairs: 1 woman; 1 man
Steering committee: 5 women, 10 men
Number of international representatives: 11
Number of industry-government members: 7
Number of academic members: 43
Professional endorsements: 21

Curricula
Computer Engineering
Computer Science
Cybersecurity
Information Systems
Information Technology
Software Engineering
(Data Science)

acm.org
→ Education
→ Curricula Recommendations
CC2020 Overall Project Goal

To produce a modern replacement for the CC2005 computing curricula document by the end of 2020
What is CC2005?

CC2005 = Computing Curricula 2005

A multi-organizational (ACM, IEEE, AIS, BCS, etc.) effort to consolidate curricular reports and hence called the “Overview Report”

Illustrates the knowledge scope of five computing disciplines
- Computer Engineering
- Computer Science
- Information Systems
- Information Technology
- Software Engineering

Provides comparison tables and visualizations contrasting the five disciplines
Visualization from CC2005
Visualization from CC2005 [2 of 4]
Visualization from CC2020
Knowledge-based Learning

Body of Knowledge

The complete set of concepts, terms and activities that make up a professional domain, as defined by the relevant professional association.

It is more than simply a collection of terms ... or a collection of information.

It is the accepted ontology for a specific domain.

[Institute for Competitive Intelligence]

Learning Outcomes

Learning outcomes are written statements of what a learner is expected to know and be able to demonstrate at the end of a learning unit (or cohesive set of units, course module, entire course, or full program).

[IT2017 Report]
Competency-based Learning

Information Systems

Competencies represent a dynamic combination of cognitive and meta-cognitive skills, demonstration of knowledge and understanding, interpersonal, intellectual and practical skills, and ethical values.

[MSIS2016 Report]

Software Engineering

[Competency is the] demonstrated ability to perform work activities at a stated competency level, which is one of five increasing levels of ability to perform an activity ...

[SWE Competency Model – 2014]
Competency-based Learning

Information Technology \(^{[a]}\)

Competence refers to the performance standards associated with a profession or membership to a licensing organization.

[IT2017 Report]

Information Technology \(^{[b]}\)

Assessing some level of performance in the workplace is frequently used as a competence measure, which means measuring aspects of the job at which a person is competent.

[IT2017 Report]
Competency Meaning [Industry]

Competency = Skills
+ Dispositions
+ Knowledge

in Context

Competency = Technical Skills + Ability + Knowledge
Competency = Technical Skills + Behavior + Knowledge
Competency = Technical Skills + Human Attributes + Knowledge
Competency Meaning [Academic]

Competency = Knowledge
+ Skills
+ Dispositions

*in Context*

Competency = Knowledge + Technical Skills + Ability
Competency = Knowledge + Technical Skills + Behavior
Competency = Knowledge + Technical Skills + Human Attributes
Disposition Meaning

Disposition relates to the human attributes and characteristics expected from computing professionals in computing environments.

Examples of dispositional attributes include:

- Communication
- Organization
- Leadership
- Mentoring
- Writing
- Planning
- Creativity
- Presentation
- Problem solving
- Multitasking
- Time management
- Team participant
Competency in IT2017 Context

**KNOWLEDGE**
- Mastery of content knowledge
- Transfer of learning

**SKILLS**
- Capabilities and strategies for higher-order thinking
- Interactions with others and world around

**DISPOSITIONS**
- Personal qualities (socio-emotional skills, behaviors, attitudes) associated with success in college and career

**PROFESSIONAL CONTEXT**
- Workplace-bound
- Employer involvement
- Expert mentorship
- Authentic problems
- Relevant IT aspects of work
- Collaborative
- Project-based
- Diverse teams
- Reflective practice
- Professional tools
Competency in IT2017 Context

**Knowledge**
- Mastery of content knowledge
- Transfer of learning

**Skills**
- Capabilities and strategies for higher-order thinking
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Competency in CC2020 Context

- Knowledge
- Skills
- Dispositions

Task
- role
- goal
- objectives
- constraints

Competency
CC2020 Accomplishments

Curricular Advancements

The CC2020 project concluded 2020 December 31

Published via the ACM Digital Library

Competency-based approach: IT2017, IS2020, DS2021

Competency-based considerations: CS202x and others

Computing the Future

Adopted the word “Computing” as a unifying term

Adopted “Competency” to represent the future of all computing programs

Competency = Knowledge + Skills + Dispositions

Set the foundation for future computing curricular reports

Develop modern visualizations to represent computing competency
CC2020 Contents

Main Body

1. Introduction
2. Evolution of Computing Education
3. Knowledge-based Learning
4. Competency-based Learning
5. Visualization of Curricula
6. Global and Professional
7. Challenges and Opportunities
8. Beyond CC2020

Appendices

A. Poster from CC2005
B. Skill Frameworks
C. Draft Competencies - Samples
D. Competency-based Curricula
E. From Competencies to Curricula
F. Repository Development
G. Additional Visualizations
H. Glossary and Nomenclature
I. Sustainable Competence in China
J. Contributors and Reviewers
Next Steps for Computing Educators

1. Review the CC2020 document
   a. Suggest doing a document scan
   b. Read Chapter 4 on competency
   c. Read other areas of interest

2. Appreciate the global scope of CC2020
   a. Significant gap exists between industry and academia
   b. Countries considering transformations
   c. China already transforming (See Appendix I of CC2020 Report)

3. Address competency-based learning
   a. Become familiar with competency
   b. Assess skills and dispositions in addition to knowledge
   c. Apply competency-based learning in courses
Thank You!

Questions?