Computing Education Research
Datavetenskapens didaktik

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Today's lecture, a brief introduction to Computer Science Education Research

1. What is Computer Science Education Research about?
2. Four examples om research in Computing Education
   A. Why do students not cheat?
   B. Why do students hand in incorrect assignments?
   C. How do students go about to learn computer systems?
   D. Which problems did Inez encounter?
3. The rest of the course. A joint decision on how to continue.

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What is Computer Science Education Research?

From the web-page of Uppsala Computing Education Research Group, UpCERG:

- Aim: Study the learning, development, and improvement of undergraduate education in computing through the use of rigorous research methods.
- The goals are pragmatic:
  - Learning of CS should become enhanced
  - Interest in CS encouraged
  - The recruitment and the retention increased
  - The universities becoming better at teaching and composing educational programs.

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Computing Education Research

A researcher in Computing studies/constructs technical artifacts/ processes

A researcher in Computing education studies how students understand/learn about technical artifacts/processes

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Computing Education Research

Example:
Cognitive science.
How many factors can a student simultaneously keep in mind?
(Miller, 1956)

Example:
Phenomenography.
How do students understand "object"?
(Eckerdal & Thuné, 2005)

Example:
Simulations.
Understanding the model of an atom
(van Heuvelen & D'Alessandris, 1999.)

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CS Education research is a cross-disciplinary field

- It draws on
  - Computer science
  - Pedagogy
  - Sociology
  - Psychology
  - Educational Technology
  - … etc

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What is learning?

- *Exercise (5 minutes): Discuss with two students sitting close to you:*
  - *What is learning?*

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One model (out of many) to describe learning

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What is the course about?

- Introduction to the field.
- Particular emphasis on research.
  - The issue of researchability delimits what we can know about the learning of computer science.
- A discussion about the nature of insights that can be gained from different research perspectives.
  - What can a computer scientist learn from these ways of thinking?

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Good reasons to take the course

- The course offers a different perspective on research in computer science, since it focuses is on how others (students) understand the CS.
- It offers ways of thinking that could be useful for those who will teach, talk about, or discuss computer science with non-computer scientists.
- It discusses the latest learning technologies the field of computer science.
- It presents the research front in computer science education.
- It can be "customized". Projects can be tailored to meet individual requests.
- It will be a fun and different learning experience.

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What is (good) research?

- *Exercise (5 minutes): Discuss with two students sitting close to you:*
  - *What is (good) research?*

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(Good) research

- An eternal issue of discussion among researchers

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A research approach = A research methodology = A research framework = A way to do research

- Offers a way to perform research in learning.
- Organizes "ways to see things".
- A specific research approach:
  - A lens with a certain focus
  - Some issues get clearer, others blurred.
- Quality can be discussed

Examples of Computing Education Research

- For each example
  - Overview
  - Data
  - Results
  - Metodology/Approach

A. Why do students not cheat? 1(3)

Statistic study, based on surveys

- Which factors do students indicate may prevent cheating?
- Survey built on related research and local experience. Likert scale, 1 - 5
- 602 (of 1189) survey answers
- Students from undergraduate and graduate level, Australia

(Sheard, Markham & Dick, 2003)

A. Why do students not cheat? 2(3)

Results

Five top answers, for undergraduate and graduate

1. Want to know what the work is worth
2. Pride of your work
3. Can get good marks without cheating
4. Against moral values
5. Penalties if caught are high

A. Why do students not cheat? 3(3)

The approach: Statistics

- Classic methods to discuss trustworthiness are available
- Well-known, well accepted within the EER community
- Often used for big samples and/or controlled experiments

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B. Why do students hand in incorrect assignments? 1(4)

Socio-cultural research perspective

- What does correctness mean for students studying computer science?
- Study in Israel
- 40 students, surveys, observations and interviews

(Ben-David Kolikant, 2005)

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B. Why do students hand in incorrect assignments? 2(4)

An observed session

- *Student: The program works. It prints some garbage at the top of the screen but that isn't important.*
- *Teacher: Show me.*
- *Student: Here, it works.*
- *Teacher: Is it the output you were expecting?*
- *Student: I don't know.*

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B. Why do students hand in incorrect assignments? 3(4)

Results

- Correctness is, for the students, not a theoretical concepts.
- Correctness is an idea about what the results mean for themselves.

This is a cultural clash.

- Academic, formalized culture leaning on definitions

vs.

- Students culture based on experience and own needs

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B. Why do students hand in incorrect assignments? 4(4)

The approach: Socio-cultural theory

- Socio-cultural theory offers a framework for
  - ... describing learning and/or development in a situation,
  - ... describing parts – whole relationships.
- Focus is on social interaction, the use of language and tools.
- Language and tools contain in themselves a social interaction and a history.
- Often used to describe and analyse “a whole” and tensions within “the whole”

(Engeström, 1987; Lave & Wenger, 1991; Säljö, 2000)

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C. How do students go about to learn computer systems? 1(4)

Phenomenographic study

- In what ways do students tackle their learning task?
- Advanced students in IT Computing in Sweden and USA
- Students produced a software system in a project course, international teams collaborating over Internet.
- Interview study with 18 students

(Berglund, 2005; Berglund & Wiggberg, 2006)

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C. How do students go about to learn computer systems? 2(4)

Two interview answers

Interviewer: Have you learnt any computer science through working in the project?

Staffan: Yes, you bet, I have found out a bit more about Linux, how you install things, and download new sources and compile them. That sort of things.

Alec: Yes, uh, just basic design, how other people think, how you should approach such a large amount of code just thrown at you. I guess, as to how I would do it in the future.

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C. How do students go about to learn computer systems? 3(4)

Results

- Seven categories, describing how students approach their studies

Learning CS is …

1. … learning to use application programs
2. … learning about isolated concepts
3. … consolidating what is already known
4. … analysing systems
5. … integrating systems
6. … giving meaning to concepts
7. … developing as a professional

Staffan

Alec

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C. How do students go about to learn computer systems? 4(4)

The approach: Phenomenography

- Describes something as it seems for a group of students.
- The result is a set of categories.
  - Each category describes a different way of understanding
- Used to explore the students' perspective

(Marton & Booth, 1997)

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D. Which problems did Inez encounter? 1(4)

Case study, critical cultural theory

- What situation does an afro-american girl, from a poor family, without an educational tradition, meet when studying Engineering?
- Narrative
- A case study

(Foor, Walden & Trytten, 2007)

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D. Which problems did Inez encounter? 2(4)

Examples of Inez' answers

Inez: I just wish I belonged more in this whole engineering group, with the students and the teachers. I never got that feeling. It might be me, I don't know.

Inez: My group for the project, actually, people did not think we were smart kids, so they called us the eccentric group. … Our project ended up winning.

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D. Which problems did Inez encounter? 3(4)

Results

- What it means to be from a culture with
  - … little information about how to be successful in higher education.
  - … a poor network (in relation to studies)
- Discussions about common myths of science, for example:
  - Science is above or beyond gender, race, class, and other socio-cultural distinction (Conefrey, 2001)
- Recommendations for Engineering Education to act so that Inez and her friends find support.

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D. Which problems did Inez encounter? 4(4)

The approach: Case study interpreted using critical cultural theory

- Case studies.
  - Here: human document
- Case studies aims to explore new fields and questions
- Critical Cultural theory.
  - Culture is an artifact which is created and re-created by a society
  - Here: The students' ability to "play the game of academia" is important for success.
- Critical Cultural theory aims to reveal underlying values
- (Plummer, 2001; Mehan, 1992; Bourdieu, 1997)

Examples of Computing Education Research

A. Why do students not cheat?
Statistic study, based on surveys
B. Why do students hand in incorrect assignments?
Socio-cultural research perspective
C. How do students go about to learn computer systems?
Phenomenography
D. Which problems did Inez encounter?
Case study,critical cultural theory

What did the examples demonstrate?

- Different research approaches offer various forms of insights.
- Variation in the perspective of …
  - … what reality is,
  - … what can be studied
  - … what can be known
  - … what the researcher's role is
  - … how research is performed
  - … which values that are implicit
  - … etc.

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Join the yahoo group

http://groups.yahoo.com/group/CERcourse_Uppsala

- Make sure that you get individual messages individually delivered to you

Computer Science Education content ←-- LAST YEAR

- **Part 1. Introduction.**
  - Introduction to Computer Science Education (CSEd) Research and Computer Science Didactics
  - Classifying CSEd Research, 1
  - Researching students' learning of computer science
  - Classifying CSEd Research, 2
  - Lab. How do students understand 'object' and 'class'.
  - Discussion seminars, learning computer science.
- **Part 2. Hot topics in Computer Science Education**
  Preliminary list
  - **Topic: Introductory programming.**
  - **Topic: Learning Technology.** Using computers to teach CS
  - **Topic: Pedagogy.** Teaching CS
  - **Topic: The CS teacher.** Computer Science teachers as amateurs, students and researchers. Given over link from University Technology Sydney, Australia
  - **Topic: Gender Issues.** Gender issues in CSEd
  - **Topic: Values in CS Eduction Research.** A critical perspective on research
  - Discussion seminars, researching computer science education. Given over link from Auckland University of Technology, NZ
- **Part 3. Project**

Computer Science Education content THIS YEAR?

- **Part 1. Introduction.**
  - Introduction to Computer Science Education (CSEd) Research and Computer Science Didactics
  - Classifying CSEd Research
  - Lecture/Seminar on Critical Research
  - Lectures about writing papers
  - Some lectures/Seminars as agreed on
- **Part 2. A joint project?**
  - *What do you think?*

Computer Science Education, course formalities

- Advanced level, 7,5 credits in Computer Science
- SP 1 and 2.
- No written exam. Instead reflections, assigments, seminars and a project.
- Responsible teacher: Anders Berglund, Anders.Berglund@it.uu.se
- Organised by the Uppsala Computing Education Research Group.
- The guests are internationally recognized researchers within the field.

Recommended lectures: Learning to write scientific papers

- I recommend lectures intended for the new Master students:
- 16/9 13:15-15:00, 1211
  - Collaboration and plagiarism. Norms and rules.
  - Anders Berglund
- 16/9 15:15-17:00, 1211
  - How to write references
  - Ivan Christoff

Literature

- Fincher, S., & Petre, M. (2004). Computer Science Education Research: Routledge Falmer
- Articles, normally distributed over www.

Assessment

Components:

- Reflections
- Active participation in seminars
- An essay
- A project (with project presentation)

Grade:

- 3,4,5,U

First assignment: A reflection

1. Read at least one of the articles presented during this lecture. Recommended articles are available on the course website.
2. Summarize the key points of the article *in your own words*
3. Present *your own opinion* about this paper.
4. Submit the text in pdf-format, using the header "CSEd Assignment 1". The file name **must** be <your familyname>1.pdf

   Dead-line: Sept 16, 12.00