Qualitative Research Projects in Computing Education Research: Examples

This talk ...

... is about qualitative research in students’ learning in computing.

... aims to show the nature of the results of different ways to perform research.

... illustrates some ways to do research (selected for their relevance in CER) with empirical results.

What does it mean to learn something?

- A “meaningless” question?
- It all depends on “what you mean by learning” or “how you see things”

A research approach/framework /methodology

- Offers a specific way to perform research in learning
- Organizes “ways to see things”
- A lens with a certain focus
- With a specific research approach: Some issues get clearer, others blurred.
- Offers theoretical stand on learning, ways to see possibilities and limitations, enables communication with other researchers etc.

Some “highlights” of quantitaive and qualitative research

<table>
<thead>
<tr>
<th>Quantitative</th>
<th>Qualitative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quantitative, numerical results</td>
<td>Descriptions</td>
</tr>
<tr>
<td>Observable variables, “hard” evidence</td>
<td>Interpretations, researcher is present</td>
</tr>
<tr>
<td>Social environment constitute an objective reality</td>
<td>Social environment is constructed</td>
</tr>
<tr>
<td>Experiments</td>
<td>Studies in naturalistic settings</td>
</tr>
<tr>
<td>Fragmented view</td>
<td>Broad understanding</td>
</tr>
</tbody>
</table>

A little more refined view

- Interpretative frameworks, theoretical foundations:
  - Positivistic
  - Non-positivistic- Interpretative
  - Critical
- Methodologies:
  - Quantitative
  - Qualitative
  - Mixed
Qualitative Research Projects in Computing Education Research

Various qualitative "research approaches" selected pragmatically:

- Phenomenography
- Socio-cultural studies
- Constructivism

These are not necessarily comparable.

Phenomenography

Key idea:
Exploring the variations in how students experience (understand, perceive) something.

Value: To study learning from the students’ perspective.
- Empirically based research approach
- Outcome: A few categories describing qualitatively different ways, in which something is experienced/understood.

The what

How do students understand the concept of “object”?

1. Object is experienced as a piece of code.
2. As above, and in addition object is experienced as something that is active in the program.
3. As above, and in addition object is experienced as a model of some real world phenomenon.

More comments: Juha

The why

“What do our students strive for?”

- Three different motives are identified:
  A. Academic achievement
  B. Project and team working capacity
  C. Social competence

- The motives can in their turn be experienced in different ways.
**The why (cont'd)**

A. Academic achievements, example

Academic achievement can be striving for:

1. Getting a grade
   
   Student: “Some of my other group members here, um, they just want to do their job good enough to pass.”

2. Learning CS for the project
   
   Interviewer: “Do you together know enough computer science?”
   
   Student: “If not, we can learn that, I believe.”

3. Learning how to learn CS

4. Learning something new
   
   Student: “I still enjoy it because I’m doing something I never did before.”

Qualitative Research Projects in Computing Education Research

**Qualitative research approaches discussed:**

- Phenomenography
- Socio-cultural studies
- Constructivism

Socio-cultural studies, activity theory, situated learning (Vygotskian tradition)

**Key idea:**

Thinking/Learning is not only influenced by the environment

Thinking/Learning is an interaction between the individual and the environment

**Value:** To explore the students’ learning in interaction with the environment (culture, tools, other students etc.)

Empirical results from socio-cultural studies in CS Education

- Why do teams of students interpret a programming task so differently? (Holland & Reeves, 1996)
- Why do our students hand in “incorrect” programs? (Ben-David Kolikant, 2005, and later work in progress)
  
  More comments: Jan

- The example: Open source community - Linux

Studying learning/work in the learning/working environment (activity theory, Yrjö Engeström)

<table>
<thead>
<tr>
<th>Subject</th>
<th>Tools</th>
<th>Object</th>
</tr>
</thead>
<tbody>
<tr>
<td>A program</td>
<td>Text editor, compiler</td>
<td>A piece of code</td>
</tr>
<tr>
<td>Rules</td>
<td>Rules for interaction</td>
<td>Community</td>
</tr>
<tr>
<td>The team</td>
<td>Division of labour</td>
<td>Who is doing what?</td>
</tr>
</tbody>
</table>

Outcome: A working program

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Constructivism

- Key idea:
  
  Students construct their own understanding of what they learn.

Value: Defines a pedagogy

- Extremely influential in school teaching.

Empirical results from constructivism in CS Education

- Students construct rules for parameters. They are only sometimes successful. (Fleury, 1991)
- Students construct their own understanding of variables. (Paz, 1996; and others)
- Software visualization in itself does not help students understanding (Mulholland, 1997)

Qualitative research projects in CER

A summary

- The perspective of what reality is, what can be studied, what can be known, what the researcher’s role is, how research is performed etc. varies.
- Qualitative research approaches in CER opens new researchable questions.
- Different research approaches offer various contributions.
- Qualitative research projects often answer why-questions by offering discussions, perspectives and insights.

More comments: Pauli

Results from constructivism in computing education research

- Think twice before using visualizations
- Explicitly teach the model of the computer
- Don’t start with abstractions
- Teach planning, teach to avoid ”bricolage”
- Don’t run to the computer
- Organize ”closed labs”

(from Ben-Ari, 2001)