History and Paradigms of Educational Technology, Part 2

Anders Mørch and Ingrid Elise Rekaa

TOOL 5100, theme 3

Lecture 7, 11.03.2008
Outline

• Paradigms in educational research
  – Computer-Aided Instruction (CAI)
  – Intelligent Tutoring Systems (ITS)
  – Logo-as-Latin/Microworlds
  – CSCL

• Paper:

From last lecture: Wegerif’s 4 orientations to learning and educational technology

- Four orientations
  - Behaviorist (--> CAI)
  - Cognitive (--> ITS)
  - Constructivist (--> Microworlds)
  - Participatory (--> dialogic approach to CSCL)

- This is slightly different from Wegerif’s classification, paralleling Koschmann’s paper on paradigms of educational technology we have next week (Theme 3)
Paradigms in educational research

• Koschmann argues that CSCL is a new paradigm in computer-supported teaching and learning
• He gives examples of three other paradigms that are distinct from CSCL and have preceded it
• Paradigm, according to Kuhn (1972):
  – Goes beyond evolution and gradual change (it is abrupt change by “punctuated equilibrium”, like a “gestalt-switch”)
  – Provides a new set of topics, tools, methodologies, and premises to be researched
  – Members of different paradigms cannot easily communicate with one another using their own scientific terminology
Paradigms of instructional technology

- Computer-aided instruction (CAI)
  - Since ca. 1960
- Intelligent Tutoring Systems (ITS)
  - Since ca. 1970
- Logo-as-Latin/Microworlds
  - Since ca. 1980
- Computer Supported Collaborative Learning
  - Since ca. 1990

*Note:* these fields are still active today, but sometimes under new umbrellas and they evolve to meet new needs (e.g. CAI -> instructional design, Logo --> Lego/Logo (Mindstorms)
Computer-Aided Instruction

- Psychological roots in behavioral science
- Focus on support for instruction in teaching situations (e.g. classroom) with the computer
- The teacher’s role is to acquire knowledge and find efficient ways to share it with the students
- Often referred to as the “acquisition-transmission” metaphor of teaching and learning
- Today often associated with instructional design, such as reusable learning objects and domain-specific repositories that domain experts (e.g. teachers) can search for teaching material
Intelligent Tutoring Systems

- The focus here is, as often in CAI, on computer support for individual learning
- More emphasis on learner than teacher compared to CAI
- Psychological roots in cognitive science and artificial intelligence (e.g. Newell & Simon, 1972)
- The computer provides a cognitive model of human information processing, representing novice and expert problem solving, and can track student performance
- An ITS provides expert advice to students as they solve problems in well-defined domains (e.g. physics, math, medical procedures)
Logo-as-Latin/Microworlds

- Instead of learning by being taught, this approach focuses on “learning by doing”
- Psychological roots in the developmental psychology of Piaget and the philosophy of education of Dewey
- Constructionism is a term that is often used as a label for this approach
- The student identifies problems they are interested in and solves them “construction,” creating and running microworlds programmed in Logo (Papert, 1980)
- Later efforts have extended this to higher level languages, e.g. using Lego/Logo (e.g. Resnick, 1990)
- High learning curve for average to low achieving students
Computer Supported Collaborative Learning

- Roots in several fields in the social sciences and socially oriented theories of learning (going back to Vygotsky, G. H. Mead, among others)
- Focus on overarching concerns that attempts to bridge the individual-social gap in interaction
- Common perspectives and sources of influence:
  - Social constructivism
  - Sociocultural theories
  - Situated and shared cognition
- We have covered this in Theme 1 of the course
Summary of 4 paradigms

<table>
<thead>
<tr>
<th>Event Marking</th>
<th>Theory of Learning</th>
<th>Model of Instruction</th>
<th>Research Issue</th>
<th>Paradigmatic Studies</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAI (Introduction of Coursewriter I)</td>
<td>behaviorist</td>
<td>programmed instruction/instructional design</td>
<td>instructional efficacy</td>
<td>Coulson et al., 1962; Gilman, 1967; Merrill et al., 1980; More &amp; Ralph, 1992; Riding &amp; Chambers, 1992</td>
</tr>
<tr>
<td>ITS (Carbonell’s dissertation)</td>
<td>Information Processing Theory</td>
<td>one-on-one tutorial, interactive</td>
<td>instructional competence</td>
<td>VanLehn, 1982; Clancey, 1983; Woolf &amp; McDonald, 1984; Koedinger &amp; Anderson, 1990</td>
</tr>
<tr>
<td>CSCL (NATO Workshop)</td>
<td>socially oriented theories of learning</td>
<td>collaborative learning</td>
<td>instruction as enacted practice</td>
<td>Roschelle (ch. 9, this vol.); Gienn et al., 1995; Griffin, Belyaeva, &amp; Soldatova, 1992; Roth (in press)</td>
</tr>
</tbody>
</table>

- See Table 1.1(p. 16) in Koschmann’s article

Lecture 7, 11.03.2008
Paradigm shift versus evolution

• In philosophy of science there has been a debate regarding the mechanisms behind the growth of scientific knowledge
  – Does it proceed according to paradigm shifts or by incremental (evolutionary) development over time?
  – The answer can be either/or or both, depending on
  – How we distinguish between different components of a research field and analyze how they change over time
    • Technologies, tools and language (artifacts) may have to be treated differently from premises, practices, and perspectives
    • For those interested: Kuhn and Popper and others have debated the development of Copernicus’ model of the solar system