History and Paradigms of Educational Technology, Part 2

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Outline

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

  Koschmann T. (1996). Paradigm Shifts and Instructional Technology: An Introduction. In: Koschmann T, (Ed). *Computer Supported Collaborative Learning: Theory and Practice of an Emerging Paradigm*. Mahwah, NJ, USA: Lawrence Erlbaum, pp. 1-23.

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 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 1.1
Some Paradigms of Research in Instructional Technology

	Event Marking Emergence of Paradigm	*Theory of Learning*	*Model of Instruction*	*Research Issue*	*Paradigmatic Studies*
CAI	Introduction of Coursewriter I (1960)	behaviorist	programmed instruction/instructional design	instructional efficacy	Coulsen et al., 1962; Gilman, 1967; Merrill et al., 1980; More & Ralph, 1992; Riding & Chambers, 1992
ITS	Carbonell's dissertation (1970)	Information Processing Theory	one-on-one tutorial, interactive	instructional competence	VanLehn, 1982; Clancey, 1983; Woolf & McDonald, 1984; Koedinger & Anderson, 1990
Logo-as-Latin	Publication of *Mindstorms* (1980)	cognitive constructivist	discovery-based learning	instructional transfer	Clements & Gullo, 1984; Lehrer & Littlefield, 1993; DeCorte et al., 1992; Verzoni & Swan, 1995
CSCL	NATO Workshop (1989)	socially oriented theories of learning	collaborative learning	instruction as enacted practice	Roschelle (ch. 9, this vol.); Glenn et al., 1995; Griffin, Belyaeva, & Soldatova, 1992; Roth (in press)

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

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