

21st century (knowledge society) abilities and the role of ICT

Anders Mørch
TOOL 5100



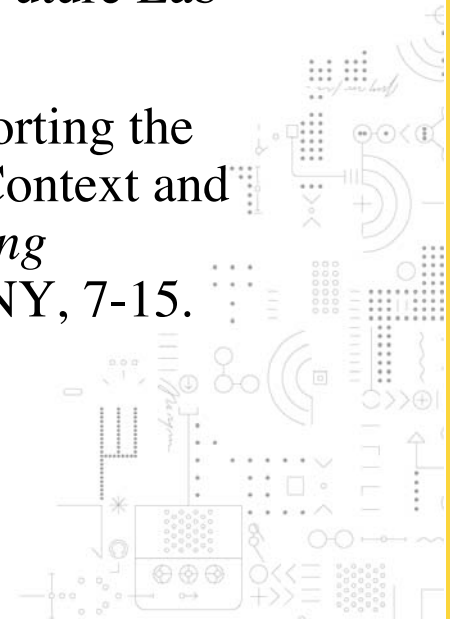
Outline

- What do we mean by 21st century abilities
- Examples and repeat from last lecture
- Scardamalia & Bereiter's position
- Wegerif's position
- Fischer et al's position



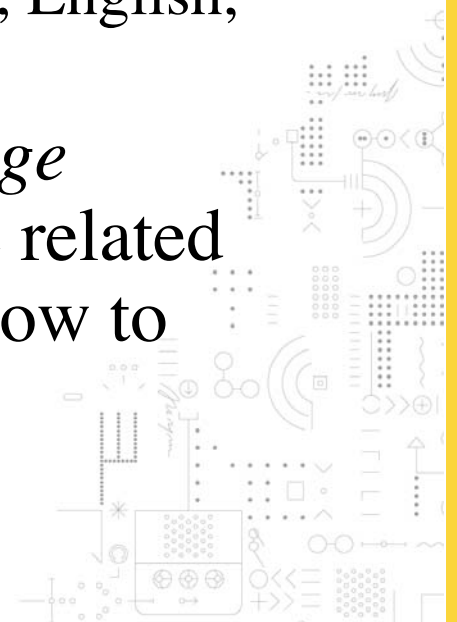
3 papers

- Scardamalia, M., & Bereiter, C. (2006). Knowledge Building: Theory, pedagogy, and Technology. In R. K. Sawyer (Ed.), *Cambridge handbook of the learning sciences*. Cambridge, UK: Cambridge University Press.
- Wegerif, R. (2002). Literature Review in Thinking Skills, Technology and Learning, A Report for NESTA, from Future Lab
- Fischer, G., Nakakoji, K., and Ostwald, J. (1995). Supporting the Evolution of Design Artifacts with Representations of Context and Intent. In *Proceedings of the 1st Conference on Designing Interactive Systems (DIS '95)*, ACM Press, New York, NY, 7-15.



Identifying knowledge society abilities

- According to experts and popular literature our basic skills need to be supplemented with the skills required for 21st century knowledge work
 - *Basic skills*: Mathematics, Physics, History, English, etc.
- Experts disagree on what these *knowledge society abilities* should be, how they are related to basic skills, how to teach them, and how to support them by by ICT



Examples of suggested abilities

- Popular literature and newspapers
 - Communication, collaboration, ability to work in groups, imagination, creativity, information-seeking, information sharing, problem solving, argumentation, digital literacy
- Bereiter & Scardamalia (1997, 2002)
 - Working with knowledge objects to clarify meaning (improvable ideas)
 - Making schools into knowledge building organizations
- Wegerif (2002)
 - Information-seeking and sorting, reasoning, problem identification, creative thinking, critical evaluation
- Fischer et al (1995)
 - Evolution of design artifacts, and communication between collaborative designers



From last lecture ..

- Stahl, Koschmann and Suthers mention basic processes and practices associated with CSCL
 - Information sharing (but beyond this)
 - Interaction
 - Negotiation
 - Joint meaning making (meaning can here mean many things)
 - Evolving common artifacts (like writing a paper together)



Knowledge practices laboratory

- In the European Knowledge practices laboratory (KP-Lab) project two of our aims are
 - Identifying emerging practices for the 21st century
 - Developing tools for supporting these practices and for transforming current practices into new ones
- We identified in KIKK case collaborative design as a knowledge practice new employees entering a product development company have to learn:
 - Joint artifact development
 - Multidisciplinary team work



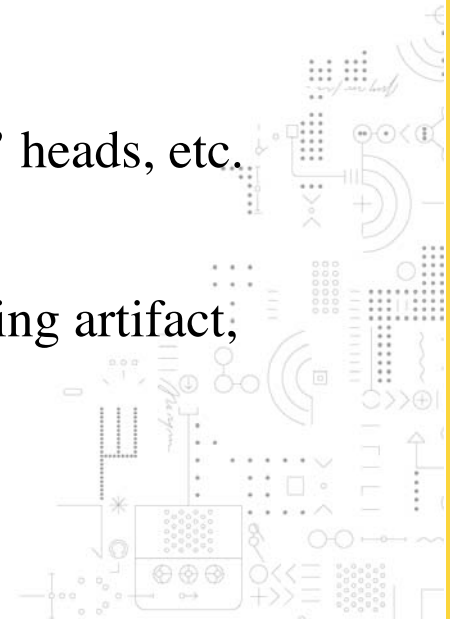
21st century abilities --> CSCL

- CSCL is supposed to be the educational technology match for knowledge society abilities
- CSCL has communication support as one of its core features, and the rest is built around that
- Knowledge society skills is more than communication, because relates to the basic (cognitive) skills in an effort to reach
 - Deep learning (Scardamalia & Bereiter))
 - Higher order thinking (Wegerif)
 - Shared context (Fischer et al.)



The three papers

- The three papers address different aspects of knowledge society abilities
- Supplement and complement each other
- Some key differences are with respect to:
 - What is locus of learning?
 - In the interaction; in shared artifacts; in students' heads, etc.
 - What role does CSCL technology play?
 - Idea generator/transformer, scaffolding an evolving artifact, prompting student reflection, etc.



Question regarding learning implications

- Stahl, Koschmann & Suthers put it in this way in the previous lecture:
 - “CSCL locates learning in meaning negotiation carried out in the social world rather than in the individuals’ heads”.
- Do you think they agree to this (completely or partially):
 - Scardamalia and Bereiter?
 - Wegerif?
 - Fischer?



Scardamalia & Bereiter's position

- Paper divided into two parts:
 - Knowledge building theory and pedagogy
 - Themes:
 - Knowledge advancement as community achievement
 - Knowledge advancement as idea improvement
 - Knowledge *of* in contrast to knowledge *about*
 - Collaborative discourse rather than argumentation
 - Constructive use of authoritative information
 - Emergent understanding
 - Knowledge building tools (Knowledge Forum)



Positioning

- The authors distance themselves from related approaches to education and tool use and claim their position (knowledge building) is neither
 - Traditional education
 - Focus on right and wrong answers; memorization; extensive testing (*knowledge about*)
 - Knowledge transmission as metaphor for teaching/learning
 - Constructivist approach
 - Self directed (active) learning (*knowledge of*)
- Instead they advocate what might be called a “third approach” (which builds on the latter)



Knowledge building

- Emphasis on
 - Collaborative problem solving as idea improvement driven by authentic problems (*knowledge of*)
 - Knowledge creation and innovation
 - Schools taking part in “civilization-wide efforts” to advance knowledge frontiers
- It is legitimated by working on problems that can be connected to problems worked on by professionals
- Goal is to advance the ‘state of knowledge’ in classroom communities



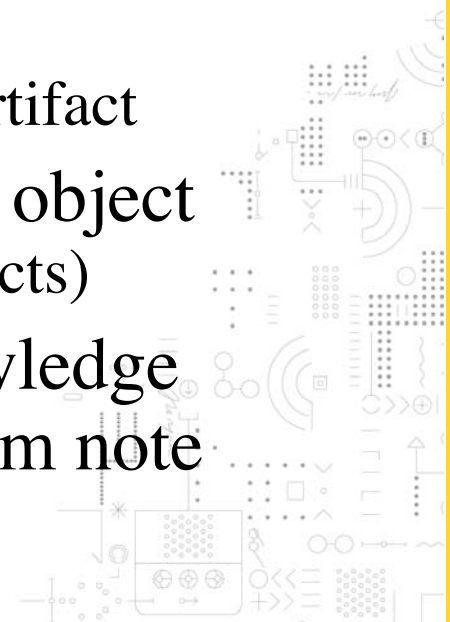
Locus of learning

- Focus on improving the state of knowledge in a given community
- This is not knowledge inside the head but knowledge in the open, represented by artifacts generated by the community
- More specific: represented by textual ideas, presented visually on computer screens and stored in a shared database
- Interface consist of textual notes associated with type and content that can be organized in views



Difficult terms

- These terms mean basically the same
 - Idea
 - Epistemic artifact
 - Conceptual artifact
- Or rather one is the more general of the other in following order:
 - Idea --> conceptual artifact --> epistemic artifact
- Think of “idea” as a Popperian World 3 object (distinguished from World 1 and World 2 objects)
- Think of “epistemic artifact” as a “knowledge object” embedded in a Knowledge Forum note



Knowledge Forum (notes and views)

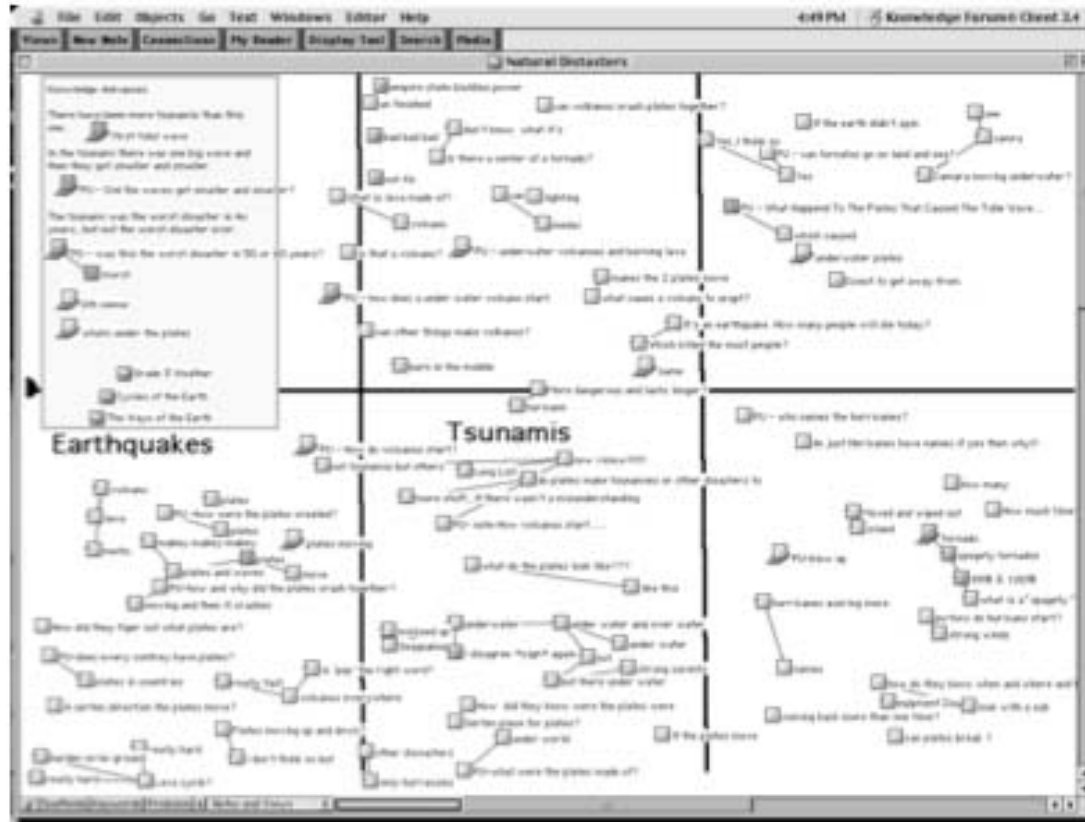
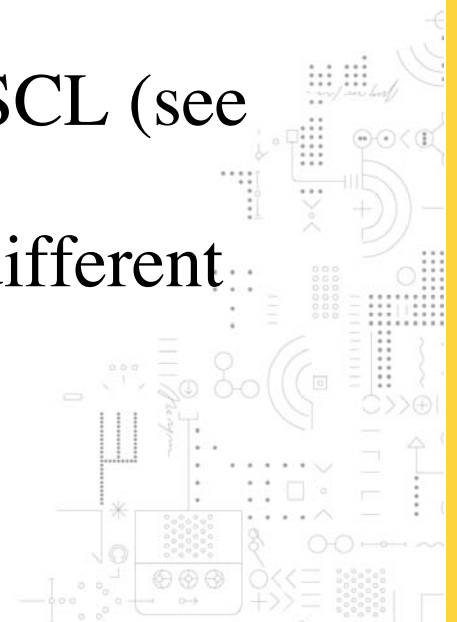


Figure 4: Rise-above view and notes by grade 3 students studying natural disasters



Wegerif's position

- This is cursory reading
- Wegerif identifies higher order thinking and show how this is related to CSCL and other paradigms of pedagogy and educational technology
- Represent a dialogical perspective to CSCL (see Theme 8) and draws on sociocultural perspectives (e.g. Vygotsky), which is different from S&B
- Gives suggestions for computer support



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)



Connection to Vygotsky's ideas

- Human learning and thinking is mediated by tool-systems
- Thinking is both individual and social (first proposed by Dewey)
- Tools can be both abstract and concrete
- Constant movement between internalization and externalization (see Theme 4)
- Wegerif suggests to teach thinking skills by integration with the teaching of basic skills



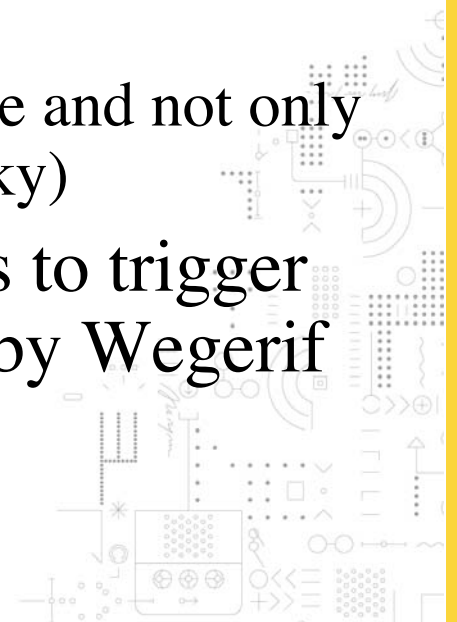
Role of technology

- More than just a mediating artifact, it is a support and resource of dialogues through which thinking skills are taught
 - Utilizing the dynamic (digital) medium and supporting multiple representation of information
 - Act likes a “teacher” to prompt and stimulate reflection and discussion during educational activity (see Theme 7 and Fischer paper)
 - Networks of knowledge creation for collaborative problem solving and distance education (see S&B paper)



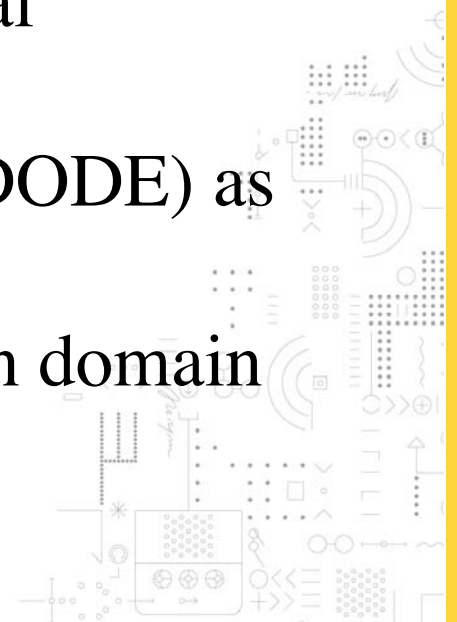
Fischer et al's position

- Describes another 21st century ability
 - Collaborative artifact development (evolution of design artifacts)
 - Communication between collaborative designers
- Addresses a shortcoming of the knowledge building approach
 - Using the computer as a scaffolding device and not only a knowledge building device (ref. Vygotsky)
- Using the computer to provide prompts to trigger reflection and discussion as suggested by Wegerif
 - Active mediation



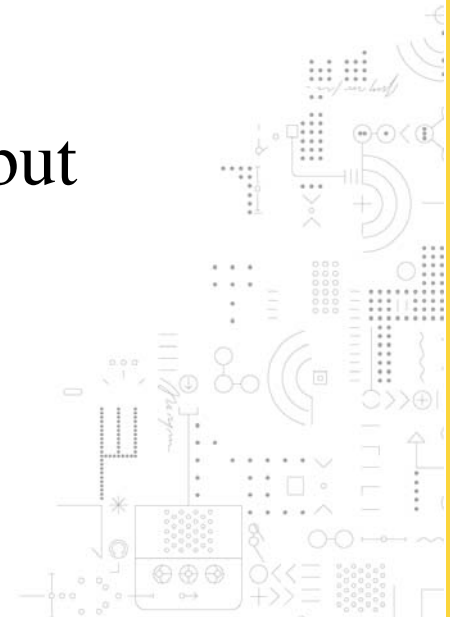
Evolution of design artifacts

- Complex artifacts need to be developed over time as part of an evolutionary process involving multiple stakeholders
- Proposes the SER model of evolutionary development (see Theme 4 for additional developmental models)
- Domain oriented design environment (DODE) as the basic tool
- Kitchen design as exemplary application domain



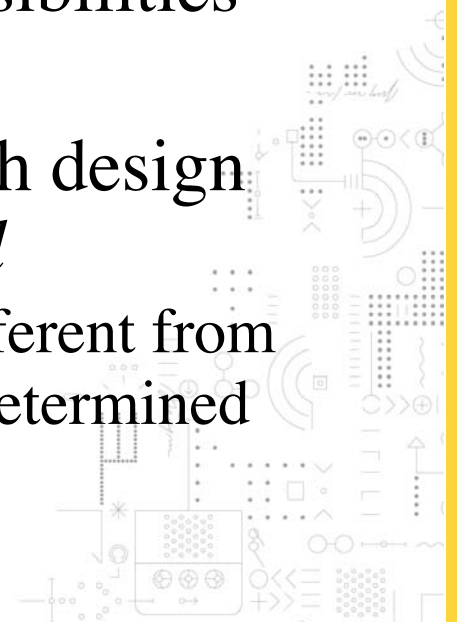
Locus of learning

- According the authors:
 - “Rather than modeling the cognitive processes of designers, DODEs augment the abilities of designers to understand, manage, and communicate complexity”
 - “design artifacts are never complete but instead are constantly evolving”



Long term collaboration

- How to communicate intent from designers to users and later developers
- They claim that representations created to communicate *intent* in the past (i.e. designers' original meaning with their artifacts) can be reused as *context* for understanding possibilities and limitations or new design proposals
- These representations are integrated with design artifacts, thus creating a kind of “*hybrid knowledge objects*” (which is therefore different from notes in Knowledge Forum whose context is determined by their knowledge type and network of links)



Scaffolding with critics

- Complex activity needs scaffolding
- The computer can complement the teacher (domain expert) in some situations
 - After hours
 - At a distance
- KID/Janus uses a computational critic mechanism to alert designers to problematic situations, such as violation of design rules and other established domain distinctions, and to provide information relevant to the situation



KID/Janus: Critiquing design to stimulate reflection, discussion and redesign

The screenshot displays the Janus-Construction software interface, which is divided into several functional areas:

- Appliance Palette:** Located on the left side, it contains icons for various kitchen elements: walls, doors, windows, sinks, and stoves.
- Catalog:** Located below the palette, it shows a preview of the current kitchen layout, labeled "L-Shaped-Kitchen".
- Work Area:** The central workspace where the kitchen layout is being designed. It includes a menu at the top with options: "Clear Work Area", "Load Catalog", "Critique All", "Save In Catalog", "Edit Global Descriptions", and "Select Context".
- Messages:** A panel at the bottom right that displays system messages. The current message reads: "The length of the work triangle (Double-Bowl-Sink-1, Four-Element-Stove-1, Single-Door-Refrigerator-1) is greater than 23 feet." and "Single-Door-Refrigerator-1 is not near Four-Element-Stove-1."
- Commands:** A panel at the bottom left of the messages area, showing a list of actions: "Critique All" and a small square icon.

Lectur

