Computer-supported collaborative learning: An introduction

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Outline

• What is CSCL
• Basic concepts
• Technologies
• Research methods
• Case: CAMO project
From CSCW to CSCL

- In CSCW, information sharing is in the foreground and communication is in the background.
- The business context has been a driver and test bed for many CSCW innovations, but many of the detailed studies has been carried out in large organizations.
- The technology developed in CSCW (groupware) has been adopted and further developed in CSCL.
- In CSCL, communication is in the foreground and information sharing in the background.
- A goal with CSCL is to connect people for the purpose of learning and developing knowledge.
Three metaphors of learning

What is collaborative learning?

• According to Stahl, Koschmann & Suthers (2006):
  – “CSCL locates learning in meaning negotiation carried out in the social world rather than in the individuals’ heads”.

• It means to take part in joint development processes with results that exceeds the sum of what the individuals can achieve on their own, variously referred to as
  – Knowledge building (Scardamalia & Bereiter, 2006)
  – Group cognition (Stahl, 2006)
  – Intersubjective learning and knowledge construction (Suthers, 2005)

• Two settings: 1) learning in groups and 2) learning through virtual collaboration (distance education)
Activities associated with CSCL

- It is hypothesized that CSCL is the right tool for 21st century (knowledge society) skills:
  - Information-seeking and sorting, reasoning, problem identification, creative thinking, critical evaluation (Wegerif, 2002),
  - Interaction, negotiation, argumentation and joint meaning-making (Stahl, Koschmann & Suthers, 2006)
  - Evolving common artifacts (Fischer, Nakakoji & Ostwald, 1995)
  - Multicultural awareness (CAMO case, this talk)
Basic concepts and their application

• Basic concepts
  – Perspective-taking (Mead, 1934)
  – Duality of learning (Vygotsky, 1978)
  – ZPD (Vygotsky, 1978)

• Related concepts
  – Scaffolding (Bruner, Wood, et al., 1976)
  – Popper’s 3 worlds (Popper, 1972)

• Evolution of educational technology
  – A new direction for ICT & learning emerged in late 1980s
  – Researchers were not satisfied with the current generation of educational technology, in particular intelligent tutoring systems (ITS) and Logo; they focused too much on individual learning (Koschmann, 1995)
Perspective-taking

• “The principle which I have suggested as basic to human social organization is that of communication involving participation in the other.” (Mead, 1934, p. 253, my emphasis)

• Two sub processes:
  – Identify a new role and learn to observe it
  – Take on the role in order to apply self-criticism and adjustment to one’s own behaviors
  – Gestures and speech provide the data for observation, according to Mead
Zone of proximal development

- ZPD is a concept introduced by the Soviet scholar and psychologist Lev Vygotsky (1978)
- It states that learning should occur in the “zone” between one’s actual development and potential developed when guided by more capable peers
- What is beyond one’s current capabilities must be “scaffolded” by teacher or more knowledge person
- How to scaffold with new media and computer support in the context of a collaborative learning session is a shared concern in CSCL research
Popper’s 3 worlds (and a possible world 4)

- The philosopher Karl Popper made a distinction between three worlds of knowledge
  - *World 1*: Physical reality, including biological entities
  - *World 2*: Mental states, subjective experience
  - *World 3*: Conceptual artifacts (theoretical ideas, concepts)
- The three worlds of Popper are connected
  - *w2* is a result of internalization of *w1* and *w3* objects and *w3* is the product (externalization) of human minds (*w2*)
- Based on lecture 2, I propose a world of intersubjectivity ("shared social reality"), which combines Popper’s *w1* & *w2*
  - Is this the realm of Fischer’s “social creativity,” a world of human minds interacting with the things they create, use and share?
  - It can be seen as an extension of Schön's (1983) notion of “reflective conversation with the materials of a design situation"
Exercise 3

• Talk to the person next to you and explain to him or her the difference between Popper’s three worlds
• Do you agree that these are the basic concepts we need to distinguish “knowledge types” in human learning?
• What do you find the most difficult to understand?
• How do you envision to use these concepts?
Three generations of CSCL tools

- First generation (1985-1995, pre-web)
  - Argumentative hypertext (hyperlinked data bases)
  - E.g. gIBIS, CSILE

- Second generation (1995-2005, web 1.0, 2.0)
  - Inquiry environments (e.g Knowledge Forum, FLE)
  - Pedagogical agents as scaffolding

- Third generation (2005 - , social media)
  - Cultures of participation (Wikipedia, 3D worlds)
  - Integration with hand held devices (smart phones)
  - Integration with 3D worlds (games, simulations)
1st generation: Hypertext for argumentation

• The *gIBIS system*: Modelled after Rittel's (1973) design rationale notation: issue, position, argument. Multiple users can edit nodes (Conklin & Begeman, 1988)
1st generation: Hypertext for argumentation

- The CSILE system: Arguably the first collaborative learning environment. Designed as a networked multimedia database with text and graphics nodes with a set of “thinking types” to scaffold collaboration (Scardamalia et al., 1989).

Hierarchy of notes:

- Pioneering CSCL tool for classroom education
- Developed at U. Toronto
- Students propose their own answers to common sense problems and based on that evolve ideas in the classroom
2nd generation: Inquiry environments

- Started with locally installed applications and local area networks (used within classroom)
- First web-based interfaces for collaborative inquiry (across classrooms and schools)
- Designs were inspired by models of inquiry, including Dewey’s theory of inquiry and Popper’s notion of evolution of knowledge by improvement of ideas
- A goal was to make professional research a model for teaching by starting with problems student can relate to
  - Problem-based learning
  - Knowledge-building (Scardamalia & Bereiter, 2006)
2nd generation: Future Learning Environment (FLE)

- FLE is based on a pedagogical model known as “progressive inquiry,” developed by Hakkarainen, and inspired by Popper’s w3 and Bereiter’s notion of conceptual artifacts.
In a study of FLE, we found that many students had difficulty choosing the right posting category for a new message or reply note (Ludvigsen & Mørch, 2003).
2nd generation: Fle3 pedagogical agents

- The agents read information from FLE database and generates feedback to the students to guide and advice their inquiry (Mørch, Dolonen & Nævdal, 2006)
3rd generation: Cultures of participation

- Cultures of participation (Jenkins, 2009; Fischer, 2011) means to engage large amounts of users in the active participation of co-construction of knowledge and artifacts
- Provided by social media, which is characterized by many users and the means for users to contribute with making content (UGC) and provide comments
- This puts new demands on education, because sometimes students are more knowledgeable than teachers, e.g. when it comes to using social media
- Offer benefits for collaborative learning when taken advantage of, but there are also pitfalls to look out
Computer-supported collaborative learning (CSCL) is a pedagogical approach wherein learning takes place via social interaction using a computer or through the Internet. This kind of learning is characterized by the sharing and construction of knowledge among participants using technology as their primary means of communication or as a common resource. CSCL can be implemented in online and classroom learning environments and can take place synchronously or asynchronously.

The study of computer-supported collaborative learning draws on a number of academic disciplines, including instructional technology, educational psychology, sociology, cognitive psychology, and social psychology. It is related to collaborative learning and computer supported cooperative work (CSCW).
3rd generation: UGC and Critique

User can write new articles in Wikipedia after establishing a user account; articles written and submitted by users are subject to critique by experts in the field.
Pros and cons of social media vs. 1\textsuperscript{st} and 2\textsuperscript{nd} generation learning environments

- Many teachers are discouraged from adopting social media due to lack of control
- \textit{Issue}: How to tap into this vast resource of information in a constructive way, or should it be defined outside of formal education?
- \textit{Position in support}: It motivates the students to search for information and to generate new content on their own and in collaboration with peers
- \textit{Position against}: Many users get stuck in unproductive social activity for prolonged time
Exercise 3

• Do you think social media should be be defined outside formal education?
• If not, what are some of the factors to consider to make social media useful for teachers as well as students?
Current trends: Integrating CSCL with physical reality using mobile devices

- E.g. to use a smartphone to collect data from a school field trip, which is then discussed with peers in group work and compared with data collected by students from other schools

Source: Rogers & Price (2008)
Current trends: Integration of social media with virtual reality (3D worlds)

- Social interaction and navigation in the 3D world Second Life, which simulates the real world and where thousands of users are logged on all around the world
Two different research methodologies

• Empirical-based research
  – Identify existing technology already in use in a specific setting (e.g. classroom)
  – Study technology in use as part of an ongoing practice of teaching and learning
  – Theoretical understanding of the learning activities

• Design-based research (design experiment)
  – Introduce a new technology to an existing practice
  – Study technology in use and changes in practice
  – Lessons learned from this, generalize?
  – Repeat if necessary
Interaction analysis

• An interdisciplinary method for "empirical investigation of human beings with each other and with objects in their environment." (Jordan & Henderson, 1995, p. 39)

• Analyzing selected extracts of spoken dialogue (participants’ talk w/each other)

• In addition: capturing body language
  – *Gestures*: laughter, nodding, pointing
  – *Actions*: handing over a document, referring to a common object, writing in a wiki, mobile recording
CAMO experiment

- The CAMO project
- Problem description
- Multicultural awareness
- Design experiment
- Methods and data collection
- Data extracts
- Preliminary findings
The CAMO project

- Cultural Awareness in Military Operations (CAMO) (http://www.uv.uio.no/intermedia/english/research/projects/camo/index.html)
- CAMO partners: Norwegian Defense University College (FHS), NTNU (IDI), UiO (InterMedia)
- Type of project: “contracted research project”
- Evaluate Second Life as a platform for teaching about multicultural awareness in a naturalistic setting
- Explore the potential of social learning and CSCL to provide alternatives to individual-oriented E-learning
- Target users: Military personnel in Norway (soldiers and interpreters) before deployment to Afghanistan
- Timeframe: 2011-2012
Multicultural awareness

- An important part of today’s training in military academies
- A recent study criticizes military training in Norway for not taking into account
  - Multiperspective awareness
    - E.g. gender differences
  - Knowledge of foreign cultural symbols
    - E.g. religious symbols
Importance of cultural context to supplement the physical context

• “In as much as it is necessary for the Norwegian armed forces to understand the physical context of its operations (e.g. climate and terrain); when deployed in foreign countries it is equally important to understand the cultural context” (NUPI report 11, 2010, p. 13, my emphasis)
The aim of mission: Peaceful meeting, information exchange, and mutual learning

Source: CAMO project
Problem description and task

- A set of learning goals was developed by the military partner (FHS)
- The learning goals were implemented in a learning scenario (FHS, IME, NTNU)
- The scenario was modeled in Second Life (NTNU)
- The experiment was evaluated by analyzing learning goals, communication and knowledge building activities (IME)
The learning goals defined by FHS

1. Minimize communication with children
2. Understand proper interaction with women
3. Recognize the physical features that distinguish an ordinary dwelling from a mosque
4. Proper greetings and introductory small talk with meeting village inhabitants
5. Be able to initiate a meeting with the chief of the village
6. Carry out a conversation with the chief of the village in order to exchange critical information
Model of Afghani village in Second Life

Buildings and terrain

Inside dwellings

Source: CAMO project

Participants
Design experiment

- One-day experiment at Norwegian military academy, Linderud, Oslo
- 11 soldiers in training to become officers (kadetter), 2 female
- In additions, 4 soldiers were interpreters
- Half of the soldiers had been in Afghanistan before
- 4 Afghani living in Norway played the role of village inhabitants
- All received 1 1/2 hours training in using Second Life in one week before the experiment
- A questionnaire on cultural awareness was filled out beforehand
Organization of experiment (25/11-11)

- Introductory movie to define mission
- Run the scenario, first time
- Debrief, change platoon leader
- Run the scenario, second time
- Evaluation (debrief, questionnaires, interviews)
- At the end all participants filled out two questionnaires, and three participants were interviewed
Experimental setting (computer lab)

Classroom 1: soldiers and interpreters
Classroom 2: Afghani village inhabitants (not shown)

Source: CAMO project

Sample screen
Attach video file: beginning (whole)
Methods and data collection

• Mixed methods approach
  – Pre- and post test
  – Interaction analysis

• Triangularization (combining data during analysis)

• Data collection
  – Questionnaires and interviews
  – Automatic data logging (video, sound and pictures of everything on screen for entire session from two of the researchers/observers computer)

• Debriefing (FHS)
Quest. data 1: Engagement

- The answers show that engagement was high for most of the participants, but not for all.
- The reason why not all were engaged is not apparent from questionnaire data, but other data sources.
Excerpt 1: Engagement

06:47  Soldat: Det første jeg tenker på i sånn rent sånn spillmessig. Det er at, greit nok at man har den sikringa, men jeg vil ikke få med meg noe av samtaLEN eller noe sånt så jeg vil ikke lære noe. Og da blir det veldig sittende å se på skjermen også okay greit hva skjer nå? Med mindre jeg zoomer inn og søker informasjonen, men da dropper jeg jo egentlig det jeg skal gjøre

Excerpt 2: Communication

Interpreter: Salam aleikum
Interpreter: I don’t get any response!
Team leader: You don’t get any response from her?
Interpreter: No

- In this excerpt, the team leader approaches an Afghani woman, and wants to talk to her with the help of a male translator
- Even though the second team leader had a female translator available, he used the male translator while talking to the woman
- One of the learning goals of the scenarios was the gender perspective.
- The soldiers had to take this perspective in to account when they communicated with the Afghani villagers
Quest. data 2: communication with injured woman

- After the first (before) test the answers were spread all around
- After the second (after) test they answered mainly: "Communication should be done by a female solder", which was focus of interaction
Communication w/injured women outside her house

Source: CAMO project
Excerpt 3: gender issues (inside house)

05:22  Female soldier: If you want us to help you bandage the wound, we have the ability to do that?

05:55  Interpreter: Yes thank you so much for the help, but there has to be a woman bandaging me

05:59  Female soldier: Yes, that’s okay. Then I will help you with your head

06:10  Female soldier: Team leader, I will use my first-aid kit to bandage her head. She wants a woman to help her.

06:20  Team leader: Message received. When you have done that, we will explain to her that there is nothing more we can do. We don’t have any doctor with us. And then you have to withdraw politely from the building, before we move further towards our primary goal.

- In this excerpt the soldiers communicate with an injured woman who hurt head when falling down from the roof, and she is in need of medical attention. A female soldier is talking to the woman through a female interpreter as ordered by the team leader.
- The Afghani woman heard the team leaders’ communication with the other soldiers outside the house, which is probably why she insist on a female soldier to help her.

Attach video file: injured-woman-part3 (from 56 til 2:10)
Excerpt 4: Information exchange

Team leader: It is nice to hear that all is well here in the village. It seems the security situation is good in the village.

Interpreter: Taliban attacked us and ISAF soldiers have returned fire

Interpreter: ISAF soldiers have ransacked the village

Interpreter: Our people get very angry over this

Interpreter: The soldiers believe that the inhabitants of the village are Taliban, but there is no Taliban here in the village. Taliban is in Pakistan

Interpreter: Pakistanis, Chechens, they are not here!

Interpreter: Our people are very good. Good people!

Team leader: Yes, but you say your self that there is Taliban attacks here. Do they come all the way from Pakistan to attack here then?

Interpreter: They come from Pakistan and hide in this area, and attack us

• This excerpt is a dialogue at the end of the conversation between the team leader and the village chief.

• the team leader has managed to get the chief to open up by starting the conversation with informal talk

• In this manner he reached the goal to get the necessary information about the presence of Taliban activity in the area.

Attach file: chief-compund-part-3 (whole)
Tentative conclusions

- The data indicates that the participants learned something about cultural awareness during the experiment and that the strengths of the experiment outweigh its weaknesses.
- There are multiple sources for the learning, one being Second Life, but not the only one.
- Follow up studies ought to verify/refute what works well and what does not work well.
- One thing to follow up is to involve the soldiers at later stages.
Summary of qualitative data

• We showed the different means the soldiers relied on to reach their goal, which was to assess Taliban activity in the village

• Four categories of findings related to learning about multicultural awareness:
  – Seeking information, negotiating sub-goals
  – Seeing a problem from multiple perspectives
    • Adapting communication to the situation
  – Taking into account gender differences
  – Informal talk to start a conversation
Summary of quantitative data

• Data from the questionnaires show that the soldiers are positive on the prospects of using 3D worlds (Second Life) for learning about multicultural awareness

• Not all the participants were active the simulation (guarding the area), and this was reflected in the data

• User friendliness and engagement was highly rated

• Some of the questions on cultural awareness had big variation from before to after-test, whereas to some did not vary much
  – Big change: Correct behavior in interacting with women; local customs
  – Less change: assessing threats from situation; internal communication
Suggestions for improvement to the design

• Design suggestions
  – Body language
    • Gestures can be improved
  – Communication
    • Less support compared to what soldiers are used to
  – Realism of SL model
    • Much is very good, but too few people to make it realistic,
    • Lack of real life context information (heat, fear, smell, etc.)
  – Types of participation (active, peripheral)
    • Those who secured the area became peripheral participants and they became marginal players