9 Cooperative Learning

9.1 Groups, Communication, and Collaboration
9.2 CSCW and CSCL
9.3 Virtual cooperative learning environments
9.4 Physical cooperative learning environments
9.5 Collaboration scripts in CSCL

References:
J. Haake/G. Schwabe/M. Wessner (Hrsg.): CSCL-Kompendium, Oldenbourg 2004 (Kap. 2.1.5)
Computer-Support in Physical Learning Rooms

- Main scenarios:
  - Enhanced classroom
    » Learners and tutor(s): at the *same time* in the *same room*
    » Electronic aids to improve
      • presentation
      • communication
      • documentation
  - Distributed enhanced classroom
    » Learners and tutor(s): at the *same time* in *different rooms*
    » Various segmentations into groups possible
    » Telecommunication is used to link rooms and to create “tele-presence”

- Possible roles of computer
  - Passive (pure support tool)
    » E.g. slide presentation system, podcast recording and publishing
  - Active (guidance, partially replacing teacher)
Basic Challenges for Learning Support

• Integration between social and technologically-mediated interaction
  – Not to replace but to enhance face-to-face communication
  – Not to inhibit face-to-face communication!

• Special features of computer-based working style in classroom:
  – Parallel work
  – Anonymisation of contributions
  – Structuring of process
  – Recording and playback
  – Interactive learning materials (e.g. simulations)
  – Automatic supervision of activities (e.g. in learning games).
eClass/Classroom2000

- Gregory Abowd, Georgia Tech
- Provision of electronic media
  - interactive whiteboards, tablet PCs
- Sophisticated automated recording (audio, video, pen strokes)
- Production of structured Web presentation
Example of Enhanced Classroom

- CONCERT Lab (Fraunhofer IPSI), 2011

http://www.ipsi.fraunhofer.de/concert/index_de.shtml?concert_lab/01_start
Example for Integration of Handheld Devices (1)

- Concert Studeo (Fraunhofer IPSI)

ConcertStudeo: Configuration & Usage Scenario

The ConcertStudeo system includes:

- **ConcertStudeo Board**
  Runs on the electronic blackboard, mainly used by teacher or tutor

- **ConcertStudeo Control**
  Runs on each of the PDAs, used by the students

- **ConcertStudeo Server**
  Runs on any PC, which is WLAN connected to ConcertStudeo Control and Board

- **ConcertStudeo Weaver**
  Runs on the ConcertStudeo Board PC; is used to integrate interactions in advance or spontaneously (“on the fly”) to already available learning content

Example for Integration of Handheld Devices (2)

- Concert Studeo (Fraunhofer IPSI)
Example for Integration of Handheld Devices (3)

- Concert Studeo (Fraunhofer IPSI)
LMU Example: BrainStorm in Instrumented Room

[Hilliges, Terrenghi, Boring, Kim, Richter, Butz 2007]
Tangible Interaction in Learning Game: Example 1

- “Read-It” (Weevers, Sluis et al. 2004):
  Memory game for children who learn to read, multimodal
Tangible Interaction in Learning Game: Example 2

- Scarlotos 2002: Tangible Interfaces for Collaborative Learning Environments (TICLE)
  - Physical Tangram puzzle with computer assistance
  - Video-based tracking based on reflective patterns
  - Background problem analyzing process, adaptive to situation
  - User interface created with Macromedia Director
Classroom-Embedded Simulation (1)

- Moher (2006)
- HelioRoom: Simulation of Solar System integrated into classroom
Classroom-Embedded Simulation (2)

- Moher (2006)
- RoomQuake: Simulation of earthquake analysis integrated into classroom
Tangibles for Controlling Simulation

- Falcão and Price, 2009: Exploring the physics of light
Tangibles as Entry Points

- Entry points invite participation
- Experiment with 3 conditions
  1. Laptop (most constrained)
  2. Multi-touch tabletop
  3. Physical-digital setup with tangible entry points (least constrained)
- Collaborative design task (idea generation, planning, decision-making, …)

Physical-digital

- More equitable participation in terms of verbal utterances
- Participants who spoke the least
  → most physical actions
  → possible for more reticent members to utilize the tangible entry points

Rogers et al., 2009
MultiSpace

- Multi-device environment
- Tabletop display as central hub
- Electronic content can be moved between tables and other devices.
- Focus group with TAs

Informal observations:

- Tabletops
  - More democratic collaboration
  - On the wall group control rarely changed
- Different devices for different tasks
  - Tabletop for layout and organization tasks (e.g. sort exam questions)
  - Wall was used for comparison tasks: Documents to the wall as a first step in collaboration…
- Supportive collaboration
  - Trouble on wall or tabletop → colleagues helped immediately
  - Trouble on laptop or tabletPC → no help

Everitt et al., 2006
Seating arrangement has strong influence
- on readability of text (various solutions possible)
- also on the style of collaboration
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References:

What is a Script?

• “[…] a script is a story or scenario that the students and tutors have to play as actors play a movie script” (Dillenbourg, 2002)

• Example: Restaurant Script

• Term comes from cognitive psychology (Schank, Abelson 1977)
  – Knowledge structure regarding a sequence of actions

• Scripting in E-Learning involves three perspectives
  1. Cognitive psychology
     • Internal: Script is a memory structure inside the user
  2. Education
     • External: script is imposed on the user
  3. Computer science

• Joining in cognitive processes: thinking, learning
• Joining in metacognitive processes: monitoring, regulating, evaluating, ...

(King, 2007) (Dillenbourg, 2002)
Specifying CSCL scripts

Components:
1. Participants (number, demographics, ...)
2. Activities (summarizing, explaining, reviewing, ...)
3. Roles (listener, summarizer, ...)
4. Resources (e.g. teaching material)
5. Groups (how to divide the participants into groups)

Mechanisms:
1. Task distribution (e.g. distribute material/information)
2. Group formation (by some principle vs. natural groups, e.g. gender)
3. Sequencing (order of events and activities)

(Kobbe, 2007)
## Taxonomy of Scripts

- **Macro scripts vs. micro scripts**

<table>
<thead>
<tr>
<th></th>
<th>Macro Script</th>
<th>Micro Script</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Approach</strong></td>
<td>Top-down</td>
<td>Bottom-up</td>
</tr>
<tr>
<td><strong>Perspective</strong></td>
<td>Pedagogical</td>
<td>Psychological</td>
</tr>
<tr>
<td><strong>Level</strong></td>
<td>Processes</td>
<td>Dialogues</td>
</tr>
<tr>
<td><strong>Example</strong></td>
<td>Structure of the collaboration process (e.g., presentation, discussion, ...)</td>
<td>Coordination of the collaboration (e.g., argument, counter argument, ...)</td>
</tr>
</tbody>
</table>

- **Imposed vs. induced**
  - Imposed means the script is explicitly shown to the user
  - Induced means it is embedded in the learning environment → higher freedom

(Kobbe, 2007), (Dillenbourg & Jermann, 2007), (Ayala, 2007)
Example Macro Script: M.U.R.D.E.R.

- Mood, Understanding, Recall, Detection, Elaboration, Review
- Supports collaborative sessions aiming at text understanding
- 2 Roles:
  - Summarizer
  - Listener

1: Reading
Each learner reads text passage

2: Summarizing
Summarizer reflects content

3: Feedback
Listener gives feedback

4: Elaborating
Both elaborate on the results

(Kobbe, 2007), (Kollar, 2006)
Example Micro Script

- Support the construction of
  1. Arguments (argument = statement + justification (“warrant”) + restriction)
  2. Argumentation sequences: (argument - counterargument - integration)

The interface of the script for argument construction (Stegmann, 2004)
Argumentation Template for CSCL
Choosing a Display Environment for Argumentative Learning

Tabletop displays …
• … encourage eye contact
  → support natural face-to-face communication [1]
• … facilitate balanced participation [2, 3]

Problems:
• Orientation
• Text input

[1] Inkpen et al., 2005
[3] Everitt et al., 2006
Research on Alternative Display Configurations

1. Individual phase
   - Increased awareness
   - Less distraction

2. Collaborative phase
   - Balanced role distribution
   - More sequences

Sara Streng (LMU) et al., CSCL 2011: ArgueTable vs. ArgueWall
Influence of the First Speaker
Two Phases of Note&Share

1. Individual phase
   • Private workspaces
   • Knowledge representations

2. Collaborative phase
   • Shared workspace
   • Knowledge sharing
Facilitate knowledge sharing:

1. **Note**: Individually create keywords (laptops)
2. **Share**: Transfer keywords to smartboard (gateway interaction technique)
Group Mirror for Brainstorming: Group Garden

- Visualization supporting brainstorming
- Flowers represent group members, tree the group

Results:
- Participants were more balanced with GroupGarden
- Brainstorming rules were supported
Groupgarden [Tausch et al, 2014]

Display in the beginning:
**Groupgarden** [Tausch et al, 2014]

Focus on quantity and balanced participation:
Groupgarden [Tausch et al. (LMU), NordiCHI 2014]

number of ideas

- Baseline
- With group mirror

- Below average
- Above average
Debate Feedback [Huber et al. (LMU), CHI 2014 Poster]
Debate Feedback: Jury and Speaker Interfaces
Debate Feedback: User Reactions [Huber et al, 2014]

• Feedback rated as helpful:
  - “immediate improvement”
  - “When all three parts are green, I receive an extra push, like a reward system”

• Negative remarks:
  - “sometimes distracting”
  - “too inflexible”

• Expert speakers confirm that the system is more appropriate for novices than experts:
  - “should be dispensable for a good speaker”
Current Research on Group Feedback Technology: Peer Feedback with Light Objects [Sarah Tausch]

Group members can provide feedback to each other during argumentation