CSCL
Computer-Supported Collaborative Learning

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Networked Computing

- Networked computing allows for new forms of collaborative learning, e.g.
  - synchronous distant collaborative learning i.e. distributed learning groups
  - synchronous face-to-face collaborative learning using electronic material
  - asynchronous collaborative learning
  - mobile and ubiquitous scenarios
General Purpose Tools

- General purpose tools for mediating communication that are used for collaborative learning
  - Email
  - Chat tools
  - Instant messengers
  - Electronic bulletin boards
  - Application sharing tools
  - Simulations
  - Phone conferences
  - Video conferences
  - etc.
Special Purpose Tool: Belvedere
Special Purpose Tool: CoolModes
CSCL Research

• CSCL research has the advantage of studying learning in settings in which learning is observably and accountably embedded in collaborative activity. Our concern, therefore, is with the unfolding process of meaning-making within these settings, not so-called “learning outcomes”. It is in this way that CSCL research represents a distinctive paradigm within IT. By this standard, a study that attempted to explicate how learners jointly accomplished some form of new learning would be a case of CSCL research, even if they were working in a setting that did not involve technological augmentation. On the other hand, a study that measured the effects of introducing some sort of CSCL application on learning (defined in traditional ways) would not (Koschmann, 2001)
Knowledge Transfer vs. Knowledge Building

- **Intelligent Tutoring System:** *Outcome-oriented*
  - Initially, the system holds the knowledge
  - Finally, the student also has the knowledge
  - The knowledge is transferred to the student

- **Collaborative Learning System:** *Process-oriented*
  - Initially, the knowledge is distributed among the students
  - Finally, the students share the knowledge, or new knowledge is created, or knowledge has been consolidated
  - The students have improved their collaboration skills
# Knowledge Building Activities

<table>
<thead>
<tr>
<th>High-Level Task</th>
<th>Cognitive Processes</th>
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</thead>
<tbody>
<tr>
<td>BRAINSTORMING</td>
<td>Introducing of new ideas that relate to the topic or task and offer a perspective not previously considered.</td>
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<tr>
<td>ARTICULATING</td>
<td>Explaining complex or difficult concepts</td>
</tr>
<tr>
<td>REACTING</td>
<td>Provide an alternative or amplified perspective on a concept previously introduced by a student.</td>
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<tr>
<td>ORGANIZING</td>
<td>Assembling existing thoughts or perspectives in such a way that a new perspective emerges.</td>
</tr>
<tr>
<td>ANALYSIS</td>
<td>Comparing or contrasting previously articulated views or putting new understanding on existing data.</td>
</tr>
<tr>
<td>GENERALIZING</td>
<td>Taking comments or data already presented and extracting new information or knowledge that applies to a broader set of conditions.</td>
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Stahl (2000)
Definitions of Collaborative Learning

- Collaboration is a “… a coordinated, synchronous activity that is the result of a continued attempt to construct and maintain a shared conception of a problem”
  Roschelle and Teasley (1995)

- “The words ‘collaborative learning’ describe a situation in which particular forms of interaction among people are expected to occur, which would trigger learning mechanisms, but there is no guarantee that that the expected interactions will actually occur.”
  Dillenbourg (1999)
Theoretical Underpinnings

- **Socio-constructivism**
  Learning is generated by an exchange of messages among individuals with different opinions (conflict). This social interaction produces a change in the mental state of the individual who transforms his representation of a given idea.

- **Socio-cultural approach**
  Learning is generated by the interchange between the inter-psychological level and the intra-psychological level. It is important that a "zone of proximal development" (Vygotsky, 1978) is established through full interactions, and conditions for mutual support are enhanced by developing interpersonal relationship among the participants.

- **Situated view**
  The environment is an integral part of the cognitive activity, and not merely a set of circumstances in which context-independent cognitive processes are performed.
Types of Support for Collaborative Learning

- Setting up initial conditions
- Over-specifying the collaboration contract with a scenario based on roles
- Scaffolding productive interactions by encompassing interaction rules in the medium
- Monitoring and regulating the interactions
Group Formation for Joint Problem Solving

- Given a number of students working on comparable problems in an open learning network
  - Find pairs of students that could potentially benefit from cooperation in a joint session.
    - \( \text{can\_help(Student1, Student2, Topic)} \leftarrow \\text{knows(Student1, Topic)} \& \text{has\_difficulty(Student2, Topic)}. \)
  - The selection can be based on such criteria as complementarity or competitiveness.

- Given a group of students
  - Select or generate a problem that forms an adequate challenge for the group as a whole.
  - The problem should not be solvable by one student's knowledge alone, but rather through the union of all the students' individual knowledge bases.
Trained Bayesian Net for Contextual Parameters

- **Availability**
  - for a quick question, for a discussion, soon, not
  - morning, lunchtime, afternoon, evening,

- **Activity**
  - PC, PDA, phone, desk, discussing, walking, meeting

- **User feedback**

- **PDA location**
  - about 20 locations

- **PC usage**
  - 0..1 mapped to no/little/mediocre/high

- **Ambient sound**
  - 0..1 mapped to no/low/high

- **PDA co-location**
  - anonymous iPAQ co-location (no/2/3/many)
Monitoring and Regulating the Interactions

Phases 1 & 2
Collect & Aggregate Interaction Data

Phases 3
Compare Current State of Interaction to Desired State

Phase 4
Offer Advice and Guidance

Current State of Interaction

Mirroring Tools

Meta-Cognitive Tools

Desired State of Interaction

Guiding Systems
Different Types of Support Tools

• Mirroring Tools
  – collect and aggregate data about the students’ interaction
  – reflect this information back to the user, for example, as graphical visualizations
  – raise students’ awareness about their actions and behaviors

• Metacognitive Tools
  – display information about what the desired interaction might look like alongside a visualization of the current state of indicators
  – provide the referents needed by the learners or human coaches to diagnose the interaction
  – users of metacognitive support tools are responsible for making decisions regarding diagnosis and remediation.

• Guiding Systems
  – propose remedial actions to help the learners
  – the desired model of interaction and the system’s assessment of the current state are typically hidden from the students
  – the system uses this information to make decisions about how to moderate the group’s interaction
Action-based Collaboration Analysis

New cards can be dragged into the workspace & individually labeled (drag mode)

Bird’s Eye View
Schematic overview of entire workspace

Discussion
Contributions are automatically marked with author’s name

Input
Users type and mark contributions here (using IBIS notation, (?,!,+,-)

Feedback
Visualization of tallied user contributions in discussion and workspace (Each user is assigned a different color)

Palette
A basic text field and 4 category fields (?,!,+,-)

Mode
Switch between drag and line mode

Visualizations
Pie charts & histograms

Saturation
The perception of red, green, or blue colors depends on the wave length of light. We are able to differentiate between 200 tones.

Let's first write down all the headlines.

Martin: Hi Bärbel (!)
Bärbel: Hi Martin (!)
marc: Is Bärbel also there (?)
marc: oh, I see (!)
Martin: Shall we do brightness before hue (?)
Bärbel: Yes (+)
marc: I have no preference (!)
Martin: I am against it (-)
Bärbel: Make a decision, marc (!)
marc: how does contrast come into play (?)
marc: ok, beforehand (+)
Bärbel: Ok (+)
marc: that’s a good idea (+)
Prompts

Feedback from Coach

Problem Description

Problem: El municipio de Monterrey ha adquirido todas las líneas de camiones para implementar un servicio muy eficiente de camiones urbanos, controlado por el municipio. Usted ha sido asignado para construir el modelo de datos (diagramas Entidad-Relación) que soportará a este servicio tomando en cuenta...

Private Individual Workspace

Shared Group Workspace

Opinion Area

Chat Area

Feedback from Coach: [Mensaje]

Opinion: [Total Agree] [Disagree] [Not Sure]

Chat: [Mensaje]
Graphical Visualization of Interaction Parameters
Sentence Opener Communication Interface

• Interaction Types
  – Request
  – Inform
  – Motivate
  – Task
  – Acknowledge
  – Discuss
  – Maintenance
  – Mediate

Example Exercise: Prepare a diagram using the Object Modeling Technique (OMT) showing relationships among the following object classes: employee, company, office, library, work contract, computer, supplies.
Trained Hidden Markov Model for Effective Knowledge Sharing
# Knowledge Sharing Interactions

## General Explanations for Each Effective Group

<table>
<thead>
<tr>
<th>Group $A_e$</th>
<th>Group $B_e$</th>
<th>Group $C_e$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Receiver requests information about KE</td>
<td>1. Receiver requests information about KE</td>
<td>1. Sharer explains or illustrates KE</td>
</tr>
<tr>
<td>2. Sharer provides explanation</td>
<td>2. Sharer provides explanation</td>
<td></td>
</tr>
<tr>
<td>3. Receiver agrees</td>
<td>3. Receiver requests further clarification</td>
<td>2. Receiver motivates / encourages</td>
</tr>
<tr>
<td></td>
<td>4. Sharer provides further clarification</td>
<td></td>
</tr>
</tbody>
</table>

## General Explanations for Each Ineffective Group

<table>
<thead>
<tr>
<th>Group $A_i$</th>
<th>Group $B_i$</th>
<th>Group $C_i$</th>
<th>Group $D_i$</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Sharer explains or gives instructions for action</td>
<td>2. Receiver acknowledges</td>
<td>2. Receiver doubts</td>
<td>2. Sharer explains poorly (no further discussion)</td>
</tr>
</tbody>
</table>