Computer-Supported Collaborative Learning (CSCL), Virtual Math Teams (VMT), Group Cognition

Gerry Stahl

Communications Analysis Workshop
February 16-18, 2010
Fiesta Resort & Conference Center, Tempe, Arizona
CSCL: computer-supported collaborative learning
CSCL: computer-supported collaborative learning

- Networked computers allow students to work, learn, explore and think in small groups of peers connected globally
- … to take advantage of online resources
- … to take advantage of computational support, simulations, tools, visualizations
- … to be scaffolded and guided by teachers, peers, agents
- … to make their thinking visible, subject to other perspectives, checking, reflection, persistence, audience
Issues of Team Cognition & Communications Analysis

- How do teams of students in CSCL settings engage in distributed cognition?
- … approach, negotiate, coordinate their tasks?
- … problem solve and achieve cognitive results?
- How can we analyze their communications to answer these questions?
- … generate and capture adequate data
- … analyze the communicative interactions
- … draw theoretically interesting findings & practically effective lessons
VMT: virtual math teams

VMT: virtual math teams

(n^2 + (n-1)^2) * 2 + n

\[
\sum_{n=1}^{n} = 4n(n+1) + (n+1)^2
\]

big square: (2n-1)^2
4 corners: n(n+1)/2 + 4

Chat:

Aznx 5/18/06 7:31:12 PM EDT: No.
Aznx 5/18/06 7:31:16 PM EDT: They didn't do.
Aznx 5/18/06 7:31:20 PM EDT: The number of squares
Quicksilver 5/18/06 7:31:25 PM EDT: oh!
Aznx 5/18/06 7:31:26 PM EDT: or the find the big square
Quicksilver 5/18/06 7:31:27 PM EDT: that formula
Quicksilver 5/18/06 7:31:31 PM EDT: I thought u meant the other one
Quicksilver 5/18/06 7:31:36 PM EDT: yeah that is ours
bwang 5/18/06 7:32:37 PM EDT: point formula out with the tools so we don't get confused
Aznx 5/18/06 7:32:49 PM EDT: So we're technically done with all of it right?
Quicksilver 5/18/06 7:32:51 PM EDT: this is ours
Quicksilver 5/18/06 7:32:58 PM EDT: all right...let's put it on the wiki
Aznx 5/18/06 7:33:02 PM EDT: That is theirs.
Quicksilver 5/18/06 7:33:05 PM EDT: ahn lets clearly explain it
Aznx 5/18/06 7:33:11 PM EDT: bwang you do it. =P
Quicksilver 5/18/06 7:33:13 PM EDT: the comments said we need details

bwang8, Quicksilver are typing
The virtual math teams project

- At Drexel University, College of Info Sci & the MathForum.com from 2002 to the present
- Software collaboration platform: portal, chat, shared whiteboard, multi-user dynamic math, web browsers, wiki, social networking
- Research service (not yet released globally), over 1000 mostly hour-long sessions with 3-4 K-12 students
- Many publications, mostly case studies
- “top of the wedding cake”
Issues of Team Cognition & Communications Analysis

- Design-based research conducts empirical exploration within practical design context
- All interactions at the group unit of analysis are captured objectively, ready for analysis
- Interaction analysis using group data sessions
- Sequential analysis based on EM/CA
Analyzing Group Cognition
Group Cognition

- A form of distributed cognition that has not been the focus of most other studies, like activity theory or CSCW, which focus on socio-technical artifact use.
- How is cognition accomplished at the small-group unit of analysis?
- Not treating the group as secondary to the individual (solo+) or to the social (socio-cultural).
- Analyze the co-construction of cognitive achievements through transactive up-take, as seen in sequential structures of communication & action in shared world.
- E.g., indexicality of reference grounded in the joint problem space.
Group-cognitive actions by groups are achieved through the building of sequential relationships at many levels of granularity among contributions by multiple participants.

Reference: network of meaning, indexical ground
Utterance: recipient design for reading’s work
Pair: projection and uptake
Move: getting the problem-solving work done
Theme: coherent interactional sequence
Session: temporal structuring and re-membering
Event: forming groups and co-constructing knowledge artifacts
<table>
<thead>
<tr>
<th>Line #</th>
<th>Aznx</th>
<th>Quicksilver</th>
<th>Gerry</th>
<th>Explicit Ref</th>
<th>Threading</th>
<th>Utterance Category</th>
<th>Adjacency Pair</th>
<th>Discourse Move</th>
<th>Conversation Theme</th>
</tr>
</thead>
<tbody>
<tr>
<td>1204</td>
<td>5/16/06</td>
<td>19:04:09</td>
<td>19:04:10</td>
<td>00:21</td>
<td>Him.</td>
<td></td>
<td></td>
<td></td>
<td>Select</td>
</tr>
<tr>
<td></td>
<td>5/16/06</td>
<td>19:04:10</td>
<td>19:04:15</td>
<td>00:06</td>
<td>Quicksilver resized some objects</td>
<td></td>
<td></td>
<td></td>
<td>Select</td>
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<td></td>
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<td>19:04:16</td>
<td>19:04:18</td>
<td>00:03</td>
<td>let's make a new problem</td>
<td></td>
<td></td>
<td></td>
<td>Select</td>
</tr>
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<td></td>
<td>5/16/06</td>
<td>19:04:18</td>
<td>19:04:18</td>
<td>00:02</td>
<td>the pyramid one that we didn't finish last time</td>
<td></td>
<td></td>
<td></td>
<td>Select</td>
</tr>
<tr>
<td></td>
<td>5/16/06</td>
<td>19:04:21</td>
<td>19:04:21</td>
<td>00:03</td>
<td>Not necessarily 3-D</td>
<td></td>
<td></td>
<td></td>
<td>Select</td>
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<td>19:04:23</td>
<td>19:04:25</td>
<td>00:05</td>
<td>[user erased message]</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>5/16/06</td>
<td>19:04:25</td>
<td>19:04:25</td>
<td>00:03</td>
<td>yeah</td>
<td></td>
<td></td>
<td></td>
<td>Select</td>
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<tr>
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<td>5/16/06</td>
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<td>19:04:29</td>
<td>00:03</td>
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<tr>
<td></td>
<td>5/16/06</td>
<td>19:04:30</td>
<td>19:04:31</td>
<td>00:02</td>
<td>ok</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>5/16/06</td>
<td>19:04:31</td>
<td>19:04:32</td>
<td>00:01</td>
<td>let's do the pyramid one</td>
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<td></td>
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<td>19:04:32</td>
<td>19:04:39</td>
<td>00:07</td>
<td>[user erased message]</td>
<td></td>
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<td>Select</td>
</tr>
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<td>5/16/06</td>
<td>19:04:39</td>
<td>19:04:56</td>
<td>00:17</td>
<td>[user erased message]</td>
<td></td>
<td></td>
<td></td>
<td>Select</td>
</tr>
<tr>
<td></td>
<td>5/16/06</td>
<td>19:05:03</td>
<td>19:05:06</td>
<td>00:13</td>
<td>how do you remove things from the board?</td>
<td></td>
<td></td>
<td></td>
<td>Select</td>
</tr>
<tr>
<td></td>
<td>5/16/06</td>
<td>19:05:10</td>
<td>19:05:10</td>
<td>00:01</td>
<td>[START:TextEditing]</td>
<td></td>
<td></td>
<td></td>
<td>Select</td>
</tr>
<tr>
<td></td>
<td>5/16/06</td>
<td>19:05:14</td>
<td>19:05:18</td>
<td>00:08</td>
<td>u select and delete</td>
<td></td>
<td></td>
<td></td>
<td>Select</td>
</tr>
<tr>
<td></td>
<td>5/16/06</td>
<td>19:05:31</td>
<td>19:05:22</td>
<td>00:04</td>
<td>it is the 2 flat sided pyramid</td>
<td></td>
<td></td>
<td></td>
<td>Select</td>
</tr>
<tr>
<td></td>
<td>5/16/06</td>
<td>19:05:32</td>
<td>19:05:32</td>
<td>00:10</td>
<td>[user erased message]</td>
<td></td>
<td></td>
<td></td>
<td>Select</td>
</tr>
<tr>
<td></td>
<td>5/16/06</td>
<td>19:05:34</td>
<td>19:05:34</td>
<td>00:02</td>
<td>oh yes...like the corner of a room</td>
<td></td>
<td></td>
<td></td>
<td>Select</td>
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<tr>
<td></td>
<td>5/16/06</td>
<td>19:05:35</td>
<td>19:05:35</td>
<td>00:02</td>
<td>[Aznx moved some objects]</td>
<td></td>
<td></td>
<td></td>
<td>Select</td>
</tr>
<tr>
<td></td>
<td>5/16/06</td>
<td>19:05:33</td>
<td>19:05:42</td>
<td>00:08</td>
<td>by the way check out our wiki page</td>
<td></td>
<td></td>
<td></td>
<td>Select</td>
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<tr>
<td></td>
<td>5/16/06</td>
<td>19:05:43</td>
<td>19:05:45</td>
<td>00:03</td>
<td>how do you delete?</td>
<td></td>
<td></td>
<td></td>
<td>Select</td>
</tr>
<tr>
<td></td>
<td>5/16/06</td>
<td>19:05:45</td>
<td>19:05:45</td>
<td>00:00</td>
<td>ok</td>
<td></td>
<td></td>
<td></td>
<td>Select</td>
</tr>
<tr>
<td></td>
<td>5/16/06</td>
<td>19:05:43</td>
<td>19:05:43</td>
<td>00:03</td>
<td>updated some stuff</td>
<td></td>
<td></td>
<td></td>
<td>Select</td>
</tr>
<tr>
<td></td>
<td>5/16/06</td>
<td>19:05:46</td>
<td>19:05:55</td>
<td>00:04</td>
<td>i see how you select</td>
<td></td>
<td></td>
<td></td>
<td>Select</td>
</tr>
<tr>
<td></td>
<td>5/16/06</td>
<td>19:05:55</td>
<td>19:05:55</td>
<td>00:06</td>
<td>but how to delete?</td>
<td></td>
<td></td>
<td></td>
<td>Select</td>
</tr>
<tr>
<td></td>
<td>5/16/06</td>
<td>19:05:56</td>
<td>19:06:08</td>
<td>00:08</td>
<td>del button on your keyboard would work</td>
<td></td>
<td></td>
<td></td>
<td>Select</td>
</tr>
<tr>
<td></td>
<td>5/16/06</td>
<td>19:06:07</td>
<td>19:06:10</td>
<td>00:04</td>
<td>[user erased message]</td>
<td></td>
<td></td>
<td></td>
<td>Select</td>
</tr>
<tr>
<td></td>
<td>5/16/06</td>
<td>19:06:10</td>
<td>19:06:10</td>
<td>00:00</td>
<td>[Aznx deleted some objects]</td>
<td></td>
<td></td>
<td></td>
<td>Select</td>
</tr>
<tr>
<td></td>
<td>5/16/06</td>
<td>19:06:10</td>
<td>19:06:11</td>
<td>00:01</td>
<td>yes</td>
<td></td>
<td></td>
<td></td>
<td>Select</td>
</tr>
</tbody>
</table>

Log of Team B
Group Event: Team B in VMT Spring Fest
2006

VMT Spring Fest
Online Session: Session 4, May 18, 2006
Individual contributions to group cognition in the team interaction are inter-related at many levels under complex constraints in non-determinate rule-governed ways.
<table>
<thead>
<tr>
<th>Time</th>
<th>Communication from</th>
<th>Communication to</th>
<th>Purpose of communication</th>
<th>Content of communication</th>
<th>Outcomes of communication</th>
<th>Supporting artefacts</th>
<th>Data code</th>
</tr>
</thead>
<tbody>
<tr>
<td>15:38</td>
<td>BN</td>
<td>BN</td>
<td>To inform echo won't be done until tomorrow and that he will remove some lines.</td>
<td>Echo aren't coming till tomorrow so I'll get the (lines?) out</td>
<td>Agreed the lines will be removed</td>
<td>drug/feeds tubes</td>
<td>planning</td>
</tr>
<tr>
<td>15:40</td>
<td>BN</td>
<td>BN</td>
<td>Establish whereabouts of endoscope.</td>
<td>Endoscope to hand anywhere?</td>
<td>BN says he put it &quot;out there&quot;</td>
<td>nil</td>
<td>execution</td>
</tr>
<tr>
<td>15:51</td>
<td>Ward clerk</td>
<td>BN</td>
<td>Requests the BN move patient onto left side as echo team are arriving shortly.</td>
<td>Echo - yes - now? I've been told it needs to be done today. They want to come now. Can the patient be rolled on her left side? If she has to. Left side please. They'll be here in 5. When they get here I'll worry about it then. She doesn't need the defibrillator...30 to 40 minutes or so.</td>
<td>Nurse continues speaking with patient's mother</td>
<td>nil</td>
<td>execution</td>
</tr>
<tr>
<td>15:56</td>
<td>Echo specialist</td>
<td>BN</td>
<td>To complete echo and share information from it.</td>
<td>I'm here to do the ultrasound. Can she go on her left - is that uncomfortable for her? No she's sedated. She's not had the greatest day, we'll see how she goes. Can we roll her sitting up abit, that ok with you. That's fine. Do we know height and weight? I'll have a look. Yep, got height and weight. I'll turn sedation up for you... are we on propofol. How much levo? She on 4 of levo. She's got a swan in. Does she have CVP? Yes - 8. Height is 177. Weight is 60..... can you put bed up a smidge? Has she got swan in or pacing? Swan. Can you see that? Don't usually see that imaging... how long ago was transplant? day 6 today. How did it go? She hasn't got severe TCR anymore, she's got mild, moderate... 3 3's are 9 = 36 plus CVP of 8, so it's at 44...LV function normal, RV still dilated and moderately reduced but it's improved...good news...</td>
<td>Patient has echo and BN is updated on ultrasound results.</td>
<td>Echo machine</td>
<td>execution/planning</td>
</tr>
<tr>
<td>16:25</td>
<td>Lung transplant physician</td>
<td>Res</td>
<td>Theorising possible causes of complications?</td>
<td>(initial conversation out of range). The other one's a very rare kind of hypermia syndrome that I've only ever seen...very unlikely with the explanation...the one case we've seen the liver was playing up a bit we didn't appreciate that you can have one number way out of proportion enough to call (ventral cerebral leno) - this is due to cyclo?. yeah, a bizarre rare effect. Only seen one case out of 1000's of lungs...but it's a cheap test. ...yes exactly but she's day 6. ICU Attending isn't worried about it - maybe nothing. Just to think about it and be one step ahead of any problems. The cyclo story, if it's there.... This stage, the lungs will sort themselves out.</td>
<td>No decisions made, staff have shared knowledge.</td>
<td>nil</td>
<td>planning</td>
</tr>
<tr>
<td>17:10</td>
<td>BN</td>
<td>Nurse</td>
<td>sharing frustration</td>
<td>I wanna get the drains out so I can do other stuff, but no-one's around.... Nevermind nurse continues to wait for a</td>
<td>nil</td>
<td>planning</td>
<td></td>
</tr>
</tbody>
</table>
First thing I notice is the patient (or family) is not involved, even on a human social level or to find out how the patient feels. Why meet in the patient room if the patient is not involved?

The spreadsheet is not structured interactionally or conversationally.

I would be interested in how the medical team builds its knowledge about the patient condition and then makes its decisions in an on-going way, throughout the day and from day to day. How is this knowledge shared, co-constructed, preserved, remembered, etc. What are the roles of artifacts (e.g., paper forms)? What are the roles and relations of the team members -- how do they adhere to and deviate from or improvise around their hierarchical positions in the hospital system and how do they enact or realize these roles in practice?

I would approach these questions by looking at the sequential structure of the interactions -- looking at who initiates discourse topics and how they do that, how people position each other to play specific roles, how knowledge is co-constructed and gaps in knowledge are identified in this flow of discourse.
My Focus on Team Cognition & Communications Analysis

- I am only concerned with what is shared by the group – not in individual or cultural cognition. They are inseparable, but other researchers analyze them exclusively. I want to see what cognition looks like from a group perspective and I hypothesize (with Vygotsky) that intersubjective experience, cognition and learning can be seen as primary.

- What can communication analysis grounded in multi-level sequential analysis reveal about:
  
  -- how teams: plan tasks, solve problems, make intersubjective sense, produce group artifacts, position members in roles, enact effective teams and accomplish group cognition
  
  -- the nature of problems that teams confront: common ground, indexical reference, shared meaning, joint problem space, information behavior, coordination, recipient design of communication and reconstruction of communication coherence
For Further Information

- Workshop at ICLS 2010 in Chicago
- International Journal of CSCL
- Slides: http://www.slideshare.net/Gerry.Stahl
- Website: http://GerryStahl.net
- Email: Gerry.Stahl@drexel.edu