What are they talking about when we’re not listening?

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Collaborative learning in design

• Assertions
  – Most learning in design classes takes place in team meetings and in individual activities undertaken to help meet team goals
  
  – Argumentation, co-construction, and reflection are important elements of collaborative learning
Engineering design capstone course

- Required for all accredited engineering programs in US
- Commonly stated goal: Students should synthesize all the engineering knowledge they have acquired as undergraduates
Engineering design course projects

• The projects are usually:
  – Team-based
  – Company-sponsored (or client-driven)
  – Non-competing (each team has an independent project)
  – Often taught by academics with little project experience and even less design experience

• The grade is usually based on
  – The quality of the final product
  – The self-reported quality of the team interactions
Engineering design course projects

• Students
  – are novices in their domain knowledge
  – are novices in their knowledge of the design process
  – often judge their success by the grade they earn or by the artifacts they produce

• Teacher
  – rarely plans to use the team’s design directly
  – usually does not attend group meetings
  – often does not know if a feasible solution exists to the design problem as stated
Engineering design course projects

learning goals

activities

assessment
Collaborative learning research group

- Our focus is to develop tools that encourage process competence, constructive skills, and reflective practice
  - Need to capture process to understand student learning
  - Collaboration tools designed for industry rarely work well for student teams
  - Sequence of three National Science Foundation grants on collaborative learning in design
NSF Grant: Collaborative Learning across Time and Space

- **Goal:** To take advantage of advances in mobile computing to create collaboration tools for student design teams
- **Means:** Create an environment that
  - facilitates group collaboration for students
  - enables faculty to peer into the collaborative learning process
- **Hook:** Students design the tools they need for their own collaboration
Design education testbed

• RPCS: Rapid prototyping of computer systems
  – Interdisciplinary, capstone design course
  – Ambitious projects, e.g.
    • GM companion car-driver interface
    • Context aware cell-phone
    • Wireless classroom on the Voyager science boat
Kiva collaboration tool

- Takes advantage of students willingness to send email, use IM, post on newsgroups, send text messages
- Design goal: Create an interface that students perceive to be equivalent to their preferred communication modes; that is: 
  *make it feel like chat*
<table>
<thead>
<tr>
<th>Alan</th>
<th>I was asking which formula you wanted to use. which comes down to which regression line we are using to map from the fuel values to RPM. I used: ( y = 327.89x^3 - 2194.6x^2 + 5087.4x - 2719.1 ). ( R^2 = 0.9997 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kim</td>
<td>Ah I see.. To be quite honest, I was planning on discussing this issue during class for tomorrow. For now we can just use the one that you wrote above and we will talk more about it during tomorrow's lecture. Thanks!!</td>
</tr>
<tr>
<td>Chris</td>
<td>It also might be good to do something as a special case in the formula so that we don't return a negative number for low values of fuel consumption. It looks really weird in the dashboard. ;)</td>
</tr>
<tr>
<td>Alan</td>
<td>hehe.. Right. Thanks for testing that. :</td>
</tr>
<tr>
<td>Alan</td>
<td>Kim: I switched formulas. Now I am using this one. ( y = -1812.5x^4 + 6744.9x^3 - 8322.2x^2 + 4325.9x + 4.1796 ). ( R^2 = 0.9993 ). This is because I had to re-center the data to 0, and this new formula works much better then the alternatives. This is engine 1 I think. (the first set of numbers)</td>
</tr>
<tr>
<td>Alan</td>
<td>Sigh.. another new formula. Forgot the upper bound. ( y = -81.054x^3 + 311.21x^2 + 396.24x - 10.003 ). ( R^2 = 0.9859 )</td>
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Capturing in-process data

- For 6 years, RPCS has used the Kiva for team collaboration
  - Light-weight collaboration tool
  - Combines functions of e-mail and bboards
  - Widely accepted and liked by student teams; it feels likes chat and meets their needs
  - Each year’s Kiva has hundreds of threads and thousands of posts and files

⇒ We have 6 years of data of all the team conversations and files that would normally go through email or chat
Capturing in-process data

• Last year, we collected audio files of meetings
  – Individual speaker
  – Automated speech to text transcripts
  – Observation and coding of all team meetings

⇒ We have 1 year of data of team conversations (with many gaps)
Initial assessment strategy

- Pre and post essays on design process
- Pre and post domain knowledge tests
- Focus groups
- Coding and analysis of the posts
Group cognition: Learning in engineering project teams

• Looking for shared “meaning making” (Stahl)
• Constructing knowledge webs on the fly to trace the evolution of ideas
Questions?
Kiva vision