Patterns of Participation in Networked Classrooms

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Contextualizing students' mathematical contributions

From Student Device

Executable Representations

To Teacher Display
What are the Phenomenological Features of a Connected Classroom?

- Forms of Representational and Social Connections
- Students make personally meaningful mathematical objects to be publicly displayed and analyzed
- Students project their personal identity into their constructed and contributed mathematical objects (Kapur & Hegedus, 2004)
- Flow from private (local) to public (social) space
- Connectivity is an infrastructure to allow public collaboration, mutual expression in dynamic media, physical expression through time and space via gesture, discourse & action, and social cognition
Three mathematical affordances of mathematical classrooms

- *To harvest* students work to examine variation and common misconceptions (error analysis)
- *To aggregate* students work in a mathematically meaningful way – use natural variation to examine parametric variation (i.e. each student varies a parameter)
- *To focus on connections across representations*, i.e. students work with representation A (e.g. a velocity graph) and the teacher displays/works with representation B (e.g. a position graph) - ref. Kaput 1991
Classroom Management of Notations

- Aggregation/Receiving – allows two forms of agency in the classroom/distributed agency
- Post-Connectivity: Data management vs Representational management - role of filters to assess students’ progressive understanding (i.e. “cognitive state” timestamps) and systematically generate public reasoning and generalization
- Note: This is not always about allowing students to have ownership of the public display space - we can tightly control this
- Design challenges and solution strategies - roster as a central ordering principle; teacher orchestration
VIDEO REMOVED
PUT IT BACK!
Linguistic Anthropology to understand participation frameworks

- LA is “not just interested in language use but language as a set of symbolic resources that enter the constitution of social fabric and individual representations of the world” (Duranti, 2004: p2)

- We assume that digital technologies can be “active” participants
Goffman’s Production Format

- Animator - Person gives voice to a message
- Author - Responsible for sentiments
- Principal - Person whose beliefs are being voices
- Hearers are ratified and non-ratified participants
 Animators - A and N

 Author - Software but also an animator for the whole class

 Principal - 2 students who are not talking
Gesture & Deixis

• Participation in space and time through gesture and deixis

• Participation reframes speech not only in terms of oral but spatial expressions

• Helps us understand the flow of meaning making in a classroom with multiple participants with projected identifiable mathematical objects

• What do students focus on and differentiate by in building generalizations
Demo
<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A</strong></td>
<td>If you do it again <em>{A is standing at her desk pointing to board}</em> and you watch the bottom two people on that, the bottom two dots. <em>{She is referencing two actors that have a correct motion, but go much slower than the remainder of the class.}</em></td>
</tr>
<tr>
<td><strong>T</strong></td>
<td>Do you want me to go back to the beginning?</td>
</tr>
<tr>
<td><strong>A</strong></td>
<td>Yeah.</td>
</tr>
<tr>
<td><strong>N</strong></td>
<td>Yeah, but the longer you go-</td>
</tr>
<tr>
<td><strong>R</strong></td>
<td>It doesn’t matter.</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>----</td>
<td>---</td>
</tr>
<tr>
<td>N</td>
<td>{N is standing at front of class, facing class, next to teacher, T} If you go longer then you gotta make your slope ... {holds two hands apart at waist level, brings them together} shorter.</td>
</tr>
<tr>
<td>A</td>
<td>It doesn’t-</td>
</tr>
<tr>
<td>R</td>
<td>No, no, ‘cause if-</td>
</tr>
<tr>
<td>N</td>
<td>How’re you gonna tell me? {open arms, is still facing class, trying to lead the discussion}</td>
</tr>
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</tr>
<tr>
<td>R</td>
<td>... that part of your graph has the same slope, so that means they both have the same slope, you can’t change it. {R points both index fingers towards each other, then moves both hands together to cross fingers} {A gets out of seat, heads to front of class, then returns back to seat but remains standing}</td>
</tr>
<tr>
<td>A</td>
<td>Plus, the bottom two have this-</td>
</tr>
<tr>
<td>T</td>
<td>Robert, what you’re saying is, they both have the same slope?</td>
</tr>
<tr>
<td>R</td>
<td>Well you, those two, kept going they were partners. {A is standing, but partially turned around to face R. R repeats action from hands described above} They both had to have the same slope, and they have to keep that slope so they can meet at three.</td>
</tr>
<tr>
<td>A</td>
<td>Well they didn’t because-</td>
</tr>
<tr>
<td>R</td>
<td>In their amount of time, then they put too much time, and they went past it. {again repeats motion with hands, A sits down in seat and turns towards K}</td>
</tr>
</tbody>
</table>
Conclusions

- Students experience and contributions are embedded in a social workspace.
- Mathematical structure and understanding can be emergent, e.g. What do you expect to see before I show you the ...
- Representational infrastructure includes data management systems to manage the flow of information and examination of mathematical sub-structures; such power serves a variety of pedagogical needs, and sustains pedagogical flexibility.
• Generalization, meaning-making is driven by aesthetics/form of the aggregate, and the embedded mathematical structure of the activity - a socio-cognitive infrastructure

• Mediated and made sense of by gesture/deixis/speech (particularly metaphor) and these are inter-related at times)

• Didactic methods (for another talk) could focus on these actions but data management, i.e. what representation is shown and when and for what group highly structures meaning making, flow and focus of attention.