Levels of Articulated Reasoning In Spontaneous Face-To-Face Collaborations and Online Forum Postings Surrounding a Single-Player Physics Game in Public Middle School Classrooms

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Abstract: This poster explores the levels of reasoning articulated in (a) the spontaneous face-to-face collaborations that naturally occurred in classrooms where students were all playing a single-player game designed to support learning of Newtonian mechanics and (b) in online forums that were created for the students to share hints and strategies about each level in the game. Interestingly, levels of articulated reasoning were very low in face-to-face interactions but much higher in the online forums.

Introduction

James Gee distinguishes between the "game" and the "Game" in terms of the "game" involving the piece of software itself and the "Game" involving all of the interactions, collaboration, community, and cognition that surrounds the "game". He and others underscore the affordances for learning in these "Game" communities through both face-to-face as well virtual interactions. Research illustrates, for example, how the collaborative nature of games serves as fertile ground for problem solving (Gee, 2006) and motivating students (Trespalacios, Chamberlin, & Gallagher, 2011), as well as how language amongst players online serves as a conduit for understanding the nature of game activity in online environments (Steinkuehler, 2006) and developing scientific habits of mind in online forums (Steinkuehler & Duncan, 2008). However, less attention has been given to understanding the role of collaboration during game play in schools. Bluemink (2011) explained that two levels of interaction occurred simultaneously during game collaboration: a relational level (e.g., social interactions) and a content level, as well as that the main content of students' discussion during games involve asking, making content statements, and instructing others. Similarly, Hamalainen (2011) identified various types of interaction during game-play, with providing information (e.g., giving advice, reasoning), asking questions, and managing interactions (e.g., planning upcoming game activity) as respectively the three most prevalent. The purpose of the current study involved exploring the levels of reasoning articulated in (a) the spontaneous face-to-face collaborations that naturally occurred in classrooms where students were all playing a single-player game designed to support learning of Newtonian mechanics and (b) in online forums that were created to allow students in each classroom to share hints and strategies about each level in the game.

Methods

Four classes of public middle school students (N=101) played a version of the SURGE game for three class periods each. Every student had an individual laptop. Students chose their own tables and groups on the first day. Up to four students could sit at any one of the square tables arranged around the classroom. The game was introduced on the first day. Students were told that they were welcome to collaborate and that they could also post hints and strategies about each level for other members of their class (or read the hints and strategies about each level posted by member of their class) in online discussion boards that were created for each class.

Each class period, three researchers with video cameras moved throughout the classroom to capture episodes of collaboration that naturally occurred between students. The video of student interaction across three days of game play in four classes were analyzed, along with transcripts of students' online collaborations on the game's forum. Data analysis involved qualitative coding procedures informed by Grounded Theory (Glaser & Strauss, 1967; Strauss & Corbin, 1998). Through open coding, codes for types of collaborations and conceptual level of physics discourse were developed and refined. In the axial-coding stage, all of the class videos and forum transcripts were examined for the codes developed in the first phase and illustrative examples were identified and transcribed. Throughout this iterative process, codes and emergent findings were reviewed in consultation with members of the research team (Charmaz, 2000).

Results

Interestingly, while students collaborated face-to-face constantly, this collaboration generally took the form of requesting or specifying very concrete solutions to individual levels. As the first pie chart to the right shows, 69% of the 251 videotaped collaboration episodes involved this concrete specification as the highest level of

articulated reasoning in the episodes (and 2% of episodes were entirely non-verbal but focused on this concrete specification of solutions in the form of either pointing to places on the screen or physically taking over the other student's keyboard without discussion). Concrete reasoning, which involved discussing or sharing reasoning for solving the level without any overt connection to physics ideas, was the highest level of articulated reasoning for 8% of the episodes. Formal reasoning that included some formal physics ideas or terminology (accurate or not) accounted for 6% of the episodes. Formal reasoning that included some reference to Newton's laws (accurate or not) accounted for only 1% of the episodes. As researchers, we were interested in levels of articulated reasoning, but were disappointed by the low levels observed in face-to-face collaborations.

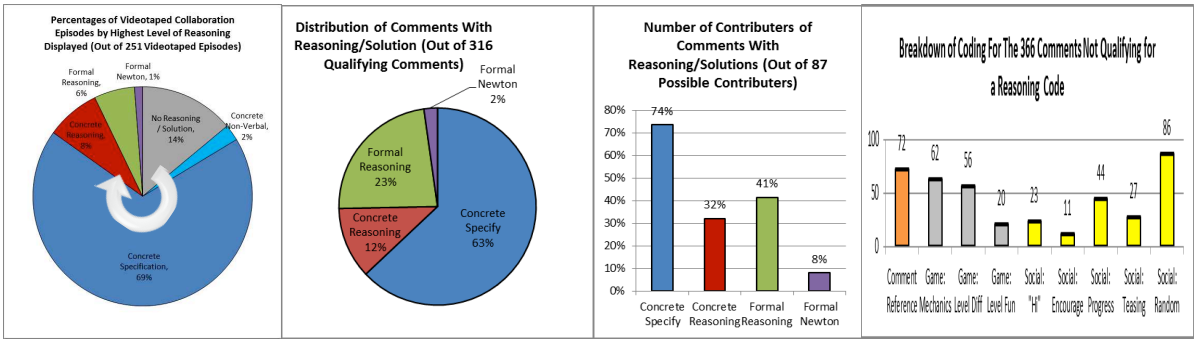

Figure 1. Distribution of Contributions

Students' posts in the online forums, however, displayed much higher levels of articulated reasoning (as shown in the pie chart to the right), which displays the highest level of reasoning in each of the 316 individual comments that articulated a solution or reasoning (out of 682 total comments posted in the online forums). Note that these are individual comments in the online forums whereas the face-to-face episodes included extended exchanges. An important and encouraging discovery was that a broad percentage of the participants contributed these comments (rather than the very small percentage of participants who typically account for most of the high level reasoning in online forums on the Internet, where the vast majority of participants are "lurkers" who do not post at all in comparison to the very tiny percentage of "super users" who account for the vast majority of high quality posts). In our study, we discovered that 87% of the students posted at least one comment in the forums that articulated some reasoning or solution, and that the comments articulating higher levels of reasoning were distributed across students. Even the 8% of comments articulating reasoning in terms of Newton's laws were all posted by different users with no user posting more than one.

We considered this relatively democratic level of contribution in the forums encouraging specifically because it occurred without explicit scaffolding or prompting. We hypothesize that this broad participation may have been facilitated by each class having its own forums such that face-to-face relationships and feedback supported and encouraged forum posting. We are hopeful that through future iterations we can explore the relationships between the comments that articulated reasoning as well as between the comments that did not articulate reasoning or solutions (which are overviewed in the graph above). Between now and the CSCL conference, we intend to conduct pattern analyses of the constellations of comments surrounding comments that articulate high levels of reasoning as well as the constellations of comments that appear to progress less productively. By understanding how the articulation of higher levels of reasoning might be scaffolded in the virtual collaborative space around games for learning in the classroom, we are hoping to learn more about how we might simultaneously support more productive natural face-to-face collaboration without suffering the costs of overscaffolding highlighted in the CSCL literature.

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