Interview Findings on Middle Schoolers' Collaboration in Self-Organizing Game Design Teams

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Abstract: Understanding how younger students can learn to collaborate, and affordances of the learning environment that can effectively support this, are critical questions for knowledge sharing, networking and innovation in education. Exploratory research results on emergent middle schooler collaborative activity in a guided discovery-based learning program are reported. Students in self-organizing game design teams experience certain challenges (e.g., version control), and innovate solutions. Some indicate meta-knowledge development and socialization gains. We conclude with ongoing questions.

"Guided discovery-based" learning experiences are those in which learners are given a particular task (e.g., a problem or a project) that must be supported by inquiry. That is, in order to successfully complete a task, the learner must develop core disciplinary knowledge as well as practices (e.g., the technical means of creating a multimedia project). Discovery denotes the need for student engagement in autonomous inquiry to support development of the core knowledge and expertise in the practices, to complete the given problem or project task. Often such complex activity is completed in teams. One example of this type of intervention is the Globaloria program, which embodies the principles of Constructionism and distributed cognition (Harel & Papert, 1991; Salomon, 1997), and is being implemented in middle and high schools in several U.S. states. Participating students engage in collaborative game design within a formal, in-school class. The primary goal from the students' perspective is successful completion and online publishing of a functioning web game, which they also enter into an annual competition. To complete a game, students participate in several integrated technology-supported activities to meet a range of instructional objectives (Reynolds & Harel, 2009). The instruction involves two less-structured areas that are largely self-organized by students: (1) resource use of a wiki-based information system containing the curriculum, online syllabus, sequence of assignments, and tutorials on game design and Flash programming, and (2) student collaboration in teams. An exploratory study was conducted to investigate students' collaborative engagement in co-located game design, as supported by the wiki environment and a studio-based classroom setting in which knowledge-sharing as a value was made explicit by teachers (Salomon, 1997). Here we discuss middle schoolers' collaborative activity that emerges when given the chance to self-organize their game design teamwork.

Methods

Intervention. In brief, Globaloria provided digital learning supports via a wiki-based social media platform, twice- teacher training, and ongoing webinars with students and teachers. In-school classes followed a blended learning curriculum daily, for up to 90 minutes per session, across either a semester or a full year. Within this curriculum, students first engaged in individual game design across 3 modules. Educators were minimally trained on supporting collaboration and teamwork processes. Students chose their own teams and largely self-organized, delegating tasks and roles. The wiki featured an informational text page text outlining team roles.

Data collection and analysis. We visited four schools in two states and interviewed 18 teams of participating Globaloria students and their teachers at two timeframes (March and May of 2012), asking about their experiences with collaboration, teamwork, and resource use. We recorded all interviews, adopting a grounded theory analysis approach to the dataset, and engaged in several rounds of coding video.

Results

Role-taking and division of labor. Teams self-reported variation in strategies for self-organization, role-taking and division of labor. For instance, some students (especially 6^{th}-graders working in pairs) worked collaboratively on shared tasks on a single computer at times, involving negotiation and decision-making for small incremental steps in the task, such as the color of a background, or figuring out the coding of buttons. Other teams reported delegating tasks, with individuals working separately and in parallel, coordinating only when deemed necessary. We found that in most teams, individuals took on varying roles they preferred (e.g., programmer, graphic designer, researcher), occasionally shifting roles. Some reported self-monitoring and evaluation of teamwork processes, and distributed expertise held by individuals at varying levels of mastery (Barron, 2003). Some teams strategically organized roles to leverage perceived strengths of individuals therein. Most teams reported some difficulties self-organizing, negotiating tasks and cooperating. Many discussed particular instances when communication broke down; several also reported pride in coming to some agreement.

Peer Help. A culture of informal peer teaching appeared to take hold in the game design classrooms. Many students reported their teachers had established a prescribed set of problem-solving steps for students to follow in seeking help: first they must visit the wiki to find answers, then ask a team member or peer in the class, and finally, the last resort is to ask the teacher for help. Certain students became recognized for their acumen in specialized areas such as programming, and were sought out by other peers in class for specific help. Teachers informed us that some of these game design leaders were under-performers in traditional school, and upon participating in this class, had made clear gains in knowledge, social standing, and self esteem. Student experts we interviewed appeared to enjoy this new role, and the value proffered by the community upon their expertise. Other students also reported gaining expertise and learning through their interactions with the expert peers.

Version Control. One challenge students faced was keeping track of game file versions. Because of variation in self-organizing teamwork processes, students required varying strategies for merging distributed work and project files. Version control issues appeared to have challenged some groups' productivity. Adobe Flash source files do not lend themselves easily to version control. Although some more advanced students reported fluency in importing work of others into a central Flash project file, such as graphics or code from other team members' files, several teams indicated confusion over this. Many reported an intention to tackle integration at the end, saving and accruing distributed work individually in files on local computer hard drives. Although the wiki was meant to help students project manage file version control, most teams noted that the wiki served as an occasional backup archive, rather than the main channel of file transfer and coordination. Teams reported using flash drives to transfer shared files, which occasionally became lost. Some teams emailed each other files. Attempting to control for the complexity of managing many different tasks, a few teams reported dedicating use of a particular computer for a particular function (e.g., "the computer on the left is where we save graphics files, and the one on the right is for coding"). Such a strategy may reveal that some students struggled to conceptualize parallel multi-tasking capabilities such as multiple file tabs in Flash project files, SWF files, folders, and file management in general. Similarly, some students reported sharing their login credentials for the wiki with each other, enabling a given individual to log into another's account and upload his/her files into the other's file gallery as one mode of transfer (when they could simply login and upload as themselves to make files accessible to all classmates on the wiki). As deadlines approached, teachers reported stepping in to scaffold and help students integrate files.

Discussion

Findings indicate that applying the instructional design decision to allow middle-schoolers to self-organize teamwork in guided discovery-based learning appears to both afford and constrain student collaboration and distributed cognition. By following an intensive collaborative design experience, some students develop insights about collaborative work processes (Barron, 2003). Students' reporting of delegation of team roles based on perceived expertise shows evidence of consciousness and meta-knowledge about roles. Comments made by some students about being sensitive to team members' feelings while delegating based on perceived expertise also reflects a certain socialization and cooperation. Although some students had difficulty with version control and file management, others seemed to develop adaptive strategies such as use of Flash drives, ultimately learning how to copy/paste features and code created by others into a central project file. It appears that version control and task delegation could be structured more by teachers and/or the curriculum and e-learning system, to facilitate greater productivity. Also, while benefits exist to allowing students to specialize in and master certain tasks (e.g., graphic design; programming; online research), if the program aims to cultivate common skills among all students in all areas, a more structured approach to role-taking must be considered to ensure students have adequate experience with practices and time on task for learning. These results lead to questions about ways in which the social tools could better support distributed expertise. Another question relates to how teachers might capitalize on emergent roles (e.g., Hmelo-Silver et al., 2007; Miller et al; 2013) while at the same time finding ways to assign roles that are important but don't emerge. Ultimately, we observe that tensions exist among: (a) the constructionist framework used in the guided discovery-based program investigated, (b) its goal to facilitate student-centered learning, (c) the need for collaborative teamwork to be productive, and, (d) formative/summative assessment constraints imposed by schools that assume common outcomes for all, that warrant further consideration and investigation. These questions have key implications for the design and implementation of computer-supported collaborative inquiry-, discovery- and project-based learning in schools.

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