Shared Inter-generational Collaborative Problem Solving Play Spaces

Abstract: We designed a five week family program where parents and children ages 9 and 12 played Quest Atlantis, a multi-user 3D educational computer-game used in middle schools internationally as part of the school curriculum. By doing that, our goal was to understand the challenges, opportunities, and collaborative work that results when parent and child are immersed within a shared inter-generational collaborative problem solving play space. Results may guide researchers, practitioners and policy makers in getting parents involved in their children's learning.

INTRODUCTION

Researchers have paid special attention to parent-child interaction in order to understand how children's complex cognitive processes develop in the context of social relationships and socio-cultural tools and practices (Vygotsky, 1978; Rogoff, 1990). Although has been found that parents continue to provide effective assistance to their children on problem solving up through ages 8 to 12 (Gleason & Schauble, 2000), parents start to engage in their children's lives less and less around middle school. This, partially, is because, as a desired learning outcome, children are expected to become independent and self-regulated learners. But another reason is specific to the socio-historical context in that we are in, one where children master new technologies faster than adults (Tapscott, 1998) and create their own cultural practices around it. Children spend much of their time outside of school playing video games through which they come to know things in new ways, to interact with other people, and to prepare for future learning and problem solving (Gee, 2003; Squire, 2006). In this light, it is one thing to talk about the educational use of video games and quite another to talk about designing educational video games where game principles are used to support the learning of academic content (Barab et al, 2007). It is our argument that educational videogames can afford a "shared inter-generational collaborative problem solving space" for parents and children where they engage in collaborative learning through playing.

The space is "shared" because neither member of these parent-child dyads *have* the solution to the open-ended problems at hand, nor are theyfamiliar with the tasks. It is also shared because of the ways in which the introduced tasks facilitate intentions that constrain and give substance to the conceptual space, a space that both parent and child come to define and work within as they attempt to solve particular challenges (Barab, Swenson, et al., 1999). Through engaging in fictional life like problems embedded in narratives, participants work towards accomplishing common goals, developing strategies, and finding solutions. This is particularly important for children's learning, because compared to experts working on problems in which they have content expertise, children when working with adults have little agency (Scardamalia & Bereiter, 1991), agency that such a designed space can provide. The space is also "inter-generational" because it brings people at different developmental levels together to allow them to exchange information in the comfort of their shared history. Unlike school work, where children work alone on academic content and a parents' only concern is to make sure that the work is done, we used an educational platform that specifically encourages parents and children to work collaboratively on problems covering socially, personally, and academically meaningful topics.

To this end, we designed a five week family program at a local afterschool site where parents and their children came to play Quest Atlantis for one and a half hours each week. Quest Atlantis is a multi-user 3D educational computer-game that has been used at elementary schools internationally to engage over 6500 children in educationally meaningful and personally engaging learning trajectories (Barab et al., 2004). Children, ages 9-12, work on educational challenges called Quests and Missions. These activities include real-world activities like analyzing newspaper articles or interviewing important people in one's community, as well as virtual activities such as investigating a virtual park that has environmental problems or learn to use similes and metaphors to interpret and provide counsel to a troubled virtual student through analysis of her journal. In this paper, we report the initial findings of the first iteration of our design experiment to understand the challenges, opportunities, and collaborative work that results when parent and child are immersed within a conceptual play space. The goal of design-based

research methodology is to develop and refine theories through studying learning phenomena in the real world within the context it emerges (Cobb, Confrey, diSessa, Lehrer & Schauble, 2003; Collins, Joseph, Bielaczye; 2004). Therefore, we also discuss the value of the findings and design changes for second iteration of the study.

THEROTICAL FRAME

Newman, Griffin, and Cole (1989) discussed the *construction zone,* referring to the shared psychological space where two minds (for example, a parent and child, instructor and student, two colleagues) meet. This non-material space is neither solely created by the instructor nor solely by the learner, but emerges through a process of joint constructive interaction mediated by common goals. Bredo (1992) likened this process to a well coordinated performance involving a "kind of dance." Bruner (1986) referred to it as "shared consciousness," and Roth (1994) used the term "collaborative construction." As learner and instructor come to hold a shared intention, the intention itself draws both into a jointly ordered system whose resources are mobilized around the goal and thus isolated from all other distracting forces. Building on this thinking, our interest was to establish an intergenerational shared conceptual space and to support collaborative work in a manner that would increase conceptual understandings at the same time strengthening familial bonds.

A core challenge was to establish a conceptual zone that would engage both parties in meaningful conceptual work. Such a merger is grounded in mutual coordination in which both parties provide input to the formation and regulation of the dyad, which then takes on a self-organizing dynamic of its own (Shaw, Kadar, Sim, & Repperger, 1992). "Because of the cooperative nature of the relationship, the two individuals can be thought of as a single organism..., a dyadic synergy" (Schmidt, et. al., 1990, p. 227). The formation of the dyad, places both parties within what Barab et al. (1999) referred to as a conditionally-isolated or intentionally-bound system. In conditionally isolating the system, a shared intention provides the boundary conditions that form the emergence of a shared psychological space. The goal is that parent and child can exploit the periodicity of the other as they merge into a single, intersubjective, reciprocal, self-organizing system (Bernieri, Reznick & Rosenthal, 1988).

Elsewhere, Barab and colleagues (Barab, in press; Barab, Dodge, Ingram-Goble, in press) have discussed conceptual play. C*onceptual play* is a state of engagement that involves projection into the role of a character who, engaged in a partly fictional problem context, applies conceptual understandings to make sense of and, ultimately, transform the context. Barab et al (2007), through various studies, have demonstrated the power of these play spaces to both engage children in significant ways, and to support deep content learning as part of their Quest Atlantis project. Our goal here was to extend this work, explicitly focusing on whether or not we could establish a collaborative conceptual play space in which both parents and children worked together to solve the task. In this way, we wanted to both expand the notion of a conceptual play space and to bring it to a new audience.

IMPLEMENTATION

Context

We set our design experiment at a local Boys and Girls Club. There are several reasons for our choice of site. First of all, the club is solely designed for youth programs and activities that allowed us to introduce our program to elementary and middle school children. 51% of the children were between ages 10 and 15. Secondly, the club services low and middle SES children. 66% of children are from minority families. This was important because we wanted the program to benefit all children. Thirdly, the club was open between 3pm and 8 pm which was convenient to set a program for parents and children where parents can attend after work.

Participants

Flyers were prepared to inform parents and children about the program, dates and registration were located at the front desk at the club where other club-related announcements were displayed. Two researchers gave a short

presentation about the program during the parent info session held at the club two weeks prior to the program starting date. Nine parent-child pairs registered the program before and two parent-child pairs registered after the program started. One parent-child pair was not able to participate because the child was younger than 9 and two parent-child dyads had to drop out because of time conflicts with their schedules. Whenanother parent-child dyad dropped out after their first session, we ended up with seven parent-child pairs participating in the program. There were two father-son dyads, three mother-daughter dyads and one mother-son dyad and one boy who came either with his mother or father. One of the father-son and mother-daughter pairs was a family. Parents held middle-class jobs such as small business manager, accounts receivable coordinator, nursing, payroll system manager, chemist, and administrator accountant. Two of the children were 9, two of them were 10 years old, and one of them was 11, 12, and 13 years old.

Intervention

In Quest Atlantis, players use an avatar to travel through virtual villages and worlds that are designed to support students learning both academic domain and social commitments. In order to complete missions, players must talk to non-player characters, gather information and artifacts, and answer questions. For this implementation, parents and children worked on introductory missions as well as missions that were related to either science or language arts domain that were assigned based on parent and child interest. There were three introductory missions that parents and children had to work on for the two first two weeks of the program. Depending on their pace, on the third week, parents and children were allowed to choose missions to work on from a list of missions related to science and language arts. One avatar and account represented both the parents and children in the virtual space. Children chose the name of the avataravatar from a list of tree names.

Data Collection

In the beginning of their first session, each parent-child signed the informed consent forms and parents filled out a 12-item questionnaire. On a 5 point-Likert scale, parents rated their own and their child's familiarity and comfort level with computers and videogames, interest in science and art related activities. Parents answered two open-ended questions about the leisure and education-related activities they do with their children. Some parents directly asked their children before they answered the child-related questions in the questionnaire. In the end of five weeks, three parent-child pairs were interviewed about their experiences. Questions include:

1. Did you find playing videogame as a family engaging?
2. How would you compare this activity with other activities you do together? (e.g. reading, watching movies)
3. Would you attend the program if it was implemented again? What improvements do you see necessary to address children's learning needs and family engagement?

During the implementation, two researchers took 'thick notes' during each session. One of the researchers was the facilitator of the program, therefore was a participant observer; interacting with the parents and children as needed and taking notes at other times. The second researcher was also a mere observer, sitting in a corner of the room and developing thick descriptions of the context and interacting with parents and children only if there was a technical problem which rarely was the case. Except the first week of the program, all sessions were audio and video taped for each parent-child pair. Audio recorders were set up in front of each computer screen where a dyad was working. Video cameras were set up in different corners of the room to provide visual clues to the interactions taking place during sessions.

RESULTS

Dyad Profiles

Pinyon, one of the father-son pairs, was the only pair where the child seemed to be catching up with technology faster than the parent. The father reported that his son was 'very familiar' and he was 'somewhat familiar' with commercial videogames. He also rated his familiarity and comfort with computers lower than his son's. Maple, Pine, Waterlocust, three mother-daughter pairs, had similar profiles. All other parents rated their own and their child's familiarity with commercial videogames as low, and their own and their children's familiarity and comfort with computers high. Roseberry and Hickory, two mother-son pairs, were commercial video-game players. The Roseberry mother reported that her son was 'somewhat' familiar and comfortable with computers, ranking herself higher than her son. The Hickory mother rated both herself and her son 'very high' on the same items. Oak, the other father-son pair, was the only pair where the father seemed to be part of the digital age. He rated himself higher on familiarity with commercial games and computers and comfort with computers than his son. All parents reported them and their children having medium to high interest in art and science-related activities. All parents did homework, watched movies, and read with their children.

Case Characterization

Session One. The facilitator introduced the Quest Atlantis backstory, then walked the participants through a user manual and the program syllabus. Although it was explained that the program was designed for parents and children working together and they were encouraged to pick a username together, all parents let their children pick their usernames which suggested that parents saw the activity primarily as a children's activity. Parents and children seemed to be excited about playing a videogame, some parent-child dyads showing more excitement over "trying something new." Some parents asked clarifying questions more than others. Some parents expressed that they would prefer to "explore" and "figure it out" with their children. Their first mission was related to exploring the virtual environment, where parents' and children's task was to watch a video about Atlantis history, to visit and gather information about two worlds in Atlantis and report what they have found to OTAK, a virtual computer that greets users when they first log in. Parents and children were observed to focus primarily on understanding how to use the tools to play the game successfully.

Sessions Two and Three. When parent-child dyads came in for the second session the following week, they were greeted and were immediately directed to a computer to continue to working from where they stopped previously. Parents and children were able to finish the tasks faster than before. However, only one parent-child dyad was able to finish the all three required missions in the end of the second session. By completing the "introductory mission," parent-child dyads earned access to an in-game tool called a Q-Pod, provides options to customize their avataravatar and enter personal information, as well as access game-relevant information. Children were excited about changing the looks of their avatar and writing about what they liked doing. Parents observed to be more distanced and let the child take over while going through I-BURST mission, where players learn about the code of conduct for using the virtual space, and the Shardflower mission, where players learn about the seven Quest Atlantis social commitments that structure the player's sense of purpose and citizenry. Relative to the first session, there may be several explanations for the parents' shift from collaborating with their children to letting the children take over. Parents might have seen their job done once their children mastered using the tools after the introductory mission. Another explanation might be that parents found I-BURST and Shardflower mission relevant to their children's experiences in the space more than theirs.

Sessions Four and Five. For the last two sessions, parents and children started working on their missions upon their arrival. By the fourth session, most parents and children were working on the mission they have chosen together. Only one parent-child dyad, in which the child was the oldest, wanted to work on science-related missions located in Taiga in addition to two language arts missions they had done. One mother-son dyad missed two sessions in a row, therefore, were behind in the program. The other mother-son dyad was not able to resolve their personal conflicts about how to move forward in the game. Often, the mother told the child what to do and complained when the child did what he felt needed to be done. On the other hand, the child complained about his mother not being any help. Only three parent-child dyads came to the final session on the fifth. One mother-daughter and one father-son dyad informed the Boys and Girls Club stuff that they were out of town. In the end of five week program, only one

parent-child dyad couldn't complete all three required missions and only one parent-child didn't work on a mission they had chosen. In total, five parent-child dyads worked on and completed the missions they had chosen.

Core Themes

Through examination of the data three core themes emerged. First, in order to share a conceptual space, the groups had to negotiate how to share tasks and mutually decide how to go about progressing on the activities which seems to be a necessity for collaboration. Second, groups had to share an intention to understand the context in order to make sense of the content. Third, the space allowed parents and children to relate to and share their personal experiences. These themes emerged at the same time as well as individually within different parenting styles.

Sharing Tasks

Successful task management outside and within the space was an important part of a successful parent-child collaboration. Parents and children shared various tasks such as parents used the mouse to click while the child was using the keyboard to move the avatar. Parents wrote down notes as the child told the answer to a question, and parents and children took turns while reading aloud. In addition, managing the ways in which parents and children go about completing the tasks determine parents' and children's progress as a team. For instance, Pine, a mother-daughter dyad, had to review the tasks they have completed and decide whether they were ready to complete the next task while working on the introductory mission:

> M: Do you know what we're doing. Let's review [checks the mission page]
> C: Alright. We've done answer questions… [referring to completed tasks] describe two worlds [refers to their next task].
> M: Do you think you remember enough to do that or should we go back and visit them again?
> C: We should go and visit them again.
> M: Ok, then. Go back to Ecology World.

Here, the mother shares the responsibility of bringing the child's attention to reviewing their progress. On the other hand, the child shares the responsibility of making a decision whether to move forward in the game. With both parties taking equal amount of load in completing the task, results in the parent and the child move as a team.

Collaborative sense making

The context in which the content was embedded helped both the child and the parent engage with the problem they needed to solve in different levels. This was important because neither the parent nor the child was in control of the learning. Learning was emerging through the parent-child interaction, as the parent and the child co-evolved as a team and in how they came to make sense of the problems they were solving. Waterlocust, a mother-daughter dyad, while working to solve the fish decay problem in Taiga, had to understand both the context and the content to come up with a solution:

> M: Can we look at the role thing [referring to the fish sales document] you picked up. So…
> C: [opens the document] Fish.
> M: Fish sales…ok…So…In each of the years, look at the fish sales.
> C: It went up.
> M: A-ha. What does that mean?
> C: More fish.
> M: Or they are charging more, one or the other. The cost looks like…
> C: Let's go to… [moves her avatar to talk to an non-player character in Taiga]

Although the parent seems to have advantage over the content information by default of being an adult, she cannot make meaning out of the data without her understanding of the context. Likewise, the child cannot make meaning of the context without developing an understanding of the content. Together, the parent and the child pulls from different resources that are available to them in the space as well as utilize the resources they bring.

Personalization

Some of the tasks brought the parents and children together by eliciting conversation about their personal lives as a basis for learning. Pinyon, a father-son dyad, had an exchange around Sally Journal Mission where they learned about metaphors and similes. Their first task was to put themselves into Sally's position. Sally is a non-player character who just moved to a new neighborhood. Then, they were asked to write a paragraph about someone they know well or something that has happened in their lives:

> F: [reads the question] Tell me what you want to say [smiles].
> C: When I first met Joseph…
> F: Ok [starts tying and repeating what he child said] When I first met Joseph…And then?
> C: I asked him if he wanted to be my friend.
> F: [continues to write] What else?
> C: He said 'yes' and we've been friends since then.
> F: What else? This is supposed to be a paragraph. What do you like about Joseph?
> C: He likes football.
> F: [types] What else?
> C:And…play in the gym.
> F: Are you still friends with him?
> C: Yeah…it's been a year now.
> F: [continues typing] He moved away, didn't he?
> C: Yeah.
> F: [continues writing] So, Joseph moved away and I also lost contact with him. [submits the essay]

Interview Data

Parents and children expressed their interest in participating in a family program like Quest Atlantis if it was implemented again. Children found playing Quest Atlantis entertaining as well as educational. One of the children said: "It can teach you something…boggles your mind, you can do things knowing that you are helping something or somebody…but it's also making your mind work…you have to answer questions to finish the quests." However, parents found playing videogames like Quest Atlantis with their children as being an activity that would be low on their list of things to do as a family. One parent expressed that she would prefer doing things such as outdoor activities, rather than playing videogames. Another parent said that she preferred playing board games as a family. All parents saw the experience to be valuable for their children's learning. One of the parents said: "I think it's a brilliant idea that it mirrors real life more ways than you might think. I think I said this before but you have a task and you have to do certain things to complete the task but the game is so huge, it is easy to get distracted…you have to keep track of multiple things that are going on at once…so it's a good practice."

DISCUSSION

Overall, regardless of their familiarity with computers and videogames, gender and age, all parents and children were able to engage and progress in Quest Atlantis. However, the determinant of the progression of a parent-child dyad seems to be whether they shared a collaborative problem solving play space or not or if the interaction was not shared. While the parents appeared to have greater content understandings, the child's greater

ease in using the technology and moving through the space to collect contextually relevant information appeared to establish a shared conceptual ground for working on the particular problems. Clearly, in such a play space, the problem to be solved needs to be contextualized in real world issues and activities, needs to be challenging and at the same time interesting for both parents and children. In this way, it was the repsonsiblity of the facilitator to constantly monitor frustration and challenge levels, with the focus of ensuring that there was an appropriate balance among collective skill and game challenges (Cziskentmihaly, 1990). Since we had not measured the parent-child baseline interaction around problem solving, we cannot argue that the themes that emerged in our analysis is the result of Quest Atlantis context only. However, it is our belief that such shared inter-generational collaborative problem solving play spaces have rich potential for bringing together families while supporting deep academic understandings.

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