Making Games After-school: Participatory Game Design in Non-Formal Learning Environments

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Introduction

The learners of today prefer to receive information quickly using many media sources, are accustomed to and prefer to multi-task, like working together, and want what they are learning to be relevant and immediately applicable (Prensky, 2006). To accommodate the preferences, skills, and abilities of today’s learners we must take a different approach to the design and development of education curriculum and media.

Online educational games, which are built on the science of learning and integrate learning objectives with the motivating, engaging and rewarding features of video games (FAS, 2006), are proving to be a powerful and necessary intervention tool that can help to improve achievement and motivation for today’s generation of learners.

Technology presents the greatest potential for traditionally underserved communities to begin to improve their conditions and get their needs met through rich learning environments that act as scaffolds to learner performance (Clark, 2005). Additionally, the effective use of technology may also assist in the multicultural development of children (Meadows & Murphy, 2004; Clark, 2008). Clark (2003) has shown that providing students with access to technology increases their self-efficacy in mathematics, science, and technology. Other research has found that student engagement increased when technology was used as a tool for exploration and experimentation (Becker, 2000; Sandholtz, Ringstaff, & Dwyer, 1997). Providing access to learning tasks and content through technology may also increase the amount of time students spend on academic activities (Clark et al., 2005). Roschelle et al (2000) suggests that technology enhances learning in children by supporting four essential characteristics of learning: active engagement, participation in groups, frequent interaction and feedback, and connections to the real-world. Effective educational games should incorporate all of these learning characteristics into their game play.

The process of educational game design provide relevance through “contextual bridging,” which will connect instruction to important needs and real-life situations (FAS, 2006). Effective educational games and game design tools allow the learner to
make mistakes in a risk free environment, and through continuous assessment the games provide them with an unlimited number of opportunities to try again (Prensky, 2006).

In game design, the student must think strategically, analyze the situation, form a plan, and follow through. Multi-tasking, rapid response, and managing their resources within the game or the design of the game is crucial in order for them to succeed (FAS, 2006). The safe, low-risk or consequence-free, realistic environment allows the student to manipulate different variables, make mistakes, try again, and use practical skills that will equip them for actual high-risk future situations. They can also role-play through games or game design. Players and designers learn how to collaborate and cooperate by sharing their knowledge, working together, and providing feedback to one another (Prensky, 2006). According to Kafai and Resnick (1996) a prominent feature of games and game design is that students are actually learning about academic subjects such as mathematics, programming, history, and physics while playing.

While much of the focus on games and learning has been on playing games, this project extends student learning by putting students in the role of game designers. When designing games or game elements, students are challenged to become meta-cognitive about how games function: how games use audio, visuals and text to communicate ideas, what helps users understand a game, what makes a game fun. The process of designing educational games also gives students control over their own learning by letting them decide on the theme, features, and content of the game. Students learn both the skills of programming and using software and to adopt the “epistemic frame” of a designer (Schaffer, 2006). In addition, since they are creating educational games, the student designers gain greater understanding of the content which they are trying to teach through the game, as well as insight into the learning and teaching process.

Non-Formal Learning Environments

Children function in three environments: home, school, and community and they should interact in the same way in all three. The problem is that in most instances students are asked to perform differently in each of these environments. When the school and community environments differ, school can seem confusing and meaningless to many children, resulting in low academic achievement (Noam, Biancarosa, & Dechausay,
Snow and colleagues (Noam, Biancarosa, & Dechausay, 2002) found that a working relationship between home and school was associated with gains in achievement. However, in spite of their concern and desire for their children’s success, many minority parents find their attempts to work as a team with the school result in confrontation instead (Noam, Biancarosa, & Dechausay, 2002). Children coming from cultures that emphasize interdependence, collaboration, and group solidarity find the independent, teacher-centered environment found in many schools to be a negative influence affecting their self-confidence and their ability to achieve academic success. After school programs, being strategically placed between school and home, have the potential to connect or bridge the multiple worlds of children. Gil Noam defines bridging as an attempt to foster a sense of continuity for youths as they traverse cultural contexts (Noam, Biancarosa, Dechausay, 2002). After school programs can bridge the gap for children between their school and community environments by linking the school and after school program so that the different communities of learning reinforce one another. Teaching and learning can take place in the community quite well since that is often where a closer connection exists between a child’s world and learning.

According to Moll and Diaz, after school programs serve as mediators, creating strategic connections between schools and communities (Noam, Biancarosa, & Dechausay, 2002). The intensity of the connection between school and after school programs can vary. Four factors influence this relationship: location, program philosophy, organizational capacity, and school climate (Noam, Biancarosa, & Dechausay 2002). Out of school facilities require sophisticated and perhaps more time intensive methods for working with a school or schools. How close the after school program matches its learning goals to the learning goals of the school can have a strong affect on the relationship.

Participatory Design

When students create the images and depictions in technology and media, they can use their cultural contexts to support multicultural development and improved links to academic content (Clark, 2008). The participatory design approach actively involves those who will be using the end product in the design and evaluation process to ensure
that the final product meets the user’s wants and needs (Nikolova-Houston, 2005). When children participate in the design process, they provide creative and honest input on what they find exciting and what they find boring as well as what helps them learn. As collaborators in the design process, children encourage adults to keep questioning, which helps to engage and motivate all participants (Druin, 2002). According to Allison Druin (2002), including children as partners in the design process can build their confidence academically and socially. Through this collaborative process children can improve communication skills while working with others towards a common goal (Druin, 2002).

There are three stages in participatory design: the discovery stage, the evaluative stage, and the prototyping stage (Nikolova-Houston, 2005). Within these three stages there are four main roles that the students play: user, tester, informant, and design partner. Our participants were primarily African American and Latino students in grades 3rd though 8th.

The discovery stage, involves gathering information regarding the learner’s preferences and needs. We reviewed extant data related to the target audience and collected data using an adapted survey instrument from the Morgan-Jinks Student Efficacy Scale. This instrument was designed to help us learn several things about the learners. We identified demographic data such as gender distribution, age range, and geographic location. Demographics were collected in order to correlate student data with our research. Learner preferences were addressed by asking questions concerning computer ownership, students’ favorite video games and web site, as well as the amount of time spent daily using a computer, playing video games, watching TV, watching movies or videos, reading for pleasure, and doing homework. The original survey that we adapted our instrument from had a primary target audience of students in grades 4 through 8 (Morgan & Jinks, 1999). Of the twenty-one surveys administered, nineteen were usable. In order to correlate students’ responses to research, let us review the general demographic information. In terms of age, eleven students were between the ages of 5 and 8 (grades K through 3), and eight students were age 10 to 13 (grades 5 through 8). Of the students surveyed, thirteen were boys and six were girls. Students surveyed included twelve African American students, five European American students, one Asian American student, and one student of mixed heritage. By ethnicity and
gender, there were: nine African American males, three African American females, three
European American males, two European American females, one Asian American
female, and one male of mixed heritage.

The results of the survey showed that students who spent too much or too little
time in combined daily media and electronics use (meaning: time using a computer, video
games, and watching TV, videos, and movies) said their classmates get better grades than
they do. Students who spent approximately 2.5 hours per day in combined media and
electronics use were most likely to report that they are doing as well or better than their
classmates in math and science. Thus we realize that striking the right balance will help
students to get the greatest benefit. It is important to note also that student success is not
only impacted by the amount of time spent but by the instructional strategies employed.

During the discovery phase, the role of the student is “user”. During this stage,
students participated in technical workshops so that they would have the skills to
participate in the design process. Because many of the participants did not have
computers at home, weekly workshops were held to provide students with basic computer
literacy through hands-on instruction. The content of the technical workshops focused on
computer applications that would be useful in video game design and development.
Microsoft Word was taught so that students would be able to write their video game
scripts, create storyboards, and document their ideas. Microsoft PowerPoint was taught so
that students could learn concepts of feedback and branching as well as visual design.
Students were introduced to the programming concepts and capabilities of Adobe Flash
to teach them about animation, graphics, and the game development process.

The second stage of participatory design is the evaluative stage. During this
phase students took on the roles of tester and informant and participated in the evaluation
of existing video games. Students participated in design workshops. The design
workshops taught students about the aspects of game design and game platforms by
having them review and examine numerous games. Games were pre-selected based on
genre and age-appropriateness. While the students were playing the games, student
interactions, comments, and behavior were noted. Students were asked direct questions
such as, “What features did you like?” “How did you know what to do?” “What did you
find boring?” The information we gathered was used to guide the design of the elements
within our gaming prototype. These elements included but were not limited to: rules and objectives, feedback given based on player action, the types of tools and navigation system, the challenges or conflict the player will face, and the story and characters within the game. Overall, girls did not like games that featured cars or sports, but preferred strategy games. Boys preferred fast-paced arcade style games. Both girls and boys did not like games that were too difficult, not easy to navigate, or did not provide clear instructions or feedback.

Prototyping is the final stage of the participatory design process. During this last stage, the students, acting as “design partners”, reviewed the game prototypes and characters and provided their input and feedback. We used their input to make revisions and modifications of the prototype to ensure that the final version met their needs. Students participated in weekly evaluations of team game and character development during the design workshops. Different iterations of the games and characters were presented to the students during this level of ongoing participation. Feedback was gathered through guided discussions, interviews, observations, and questionnaires.

The content of the baseball prototype focused on adding and subtracting fractions with like and unlike denominators no greater than 12; which correspond to the mathematics curriculum of the school district. Because lengthy instructions are often ignored by players, students decided to provide simple instructions at the beginning of the game. The initial version of the baseball prototype interface, which was provided to the students as a starting point, included a grass infield, picket fence, and trees around the outside of the field. Based on feedback from the students, the interface was changed to add more “realism” where the mathematics content and game components are seamlessly embedded (see picture below).
The content of the basketball prototype focused on comparing fractions with like and unlike denominators no greater than 12; which correspond to the mathematics curriculum of the school district. Based on the student feedback, the initial basketball prototype was changed to have more interactivity by having a bonus ball and the option to play again (see pictures below).

In both prototypes, students added multi-ethnic spectators, “not all the same color,” and an African American main character. The selection of the main character as African American was probably because the majority of the participants were themselves African American. The pitcher in the baseball prototype is male, while the basketball character is female. The gender balance between the two prototypes may have been due to the fact that one-third of the participants were female. Character design was very important to the students and they were very specific about their attributes and features. For example, they wanted to make sure that the female basketball player had long hair and did not “look too much like a man” or “have a mean face”. The students also wanted
both prototypes to have a first-person perspective so that they could control the action and interactivity of the games.

Overall, participants seemed to enjoy both the technical and design workshops, and seemed to benefit from adult interaction provided by teachers and tutors. It was also noted that although building a trusting relationship with young participants may be time consuming, is a very important aspect of implementing an effective participatory design approach.

Another important aspect is that because participants knew each other, they tended to be protective and concerned about each other. This can be positive in that the students felt comfortable much quicker than if they had been in a group of strangers. It was noted that the influence that the older students have over some of the younger students was very obvious and the younger children emulate the older children and may in fact look to them as role models. The positive side of this influence is that older participants serve as a primary support system for the younger participants. It was noted that the participants used each other as the first line of help and adult volunteers secondarily. The age of the participants may have been a factor in how involved and engaged they were in the activities. It seemed that the younger students were more engaged in activities, although there may have been a preference from the researcher to engage older students in the participatory design process because their input may have had more value to the design of the games.

Conclusion

The goal of this project was to get students of color interested in mathematics content and technology by having them participate in the design of two online game prototypes. Many of the participants had adequate technology entry skills, which was demonstrated by their ability to search the Internet, and the ease with which they learned PowerPoint. Though out the course of this project there were facilitators and barriers to the participatory design process.

One facilitator of the participatory design process was the presence of adults to assist students in their acquisition of content knowledge and participation in the technical and design workshops. An observer commented, “With individual attention, students may
become more engaged… there seems to be a need to spend one-on-one time with students in order to help them focus and become more productive.” Another facilitator to the participatory design process was the fact the students trusted one another. Peer influence can be both positive and negative, but an observer noticed that “the older students served as role models to the younger students.”

Barriers to the implementation of the participatory design process included getting students to stay focused and on task during the technical and design workshops, the self-segregation of boys and girls, and varying ages of the participants. Because participants were in grades 3 through 8, which represented a wide range of technical ability and content knowledge. In some cases, participants had to be taught the mathematics content in addition to the technology and design content. Also the level of exposure to technology also differed by age; older students tended to have more experience which often led to increased participation in the workshops.

Overall, students who were part of the participatory design process appreciated the opportunity to provide their input in the design and creation of an online game. Additionally, they took ownership of the characters, game mechanics, and visual appearance. More work needs to be done on the role of students of color in the design and development process of educational software and its impact on their knowledge acquisition and self-efficacy related to technology and design.
REFERENCES


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