# Children as Multimedia Critics: Middle School Students' Motivation for and Critical Analysis of Educational Computer Games Designed by Other Children

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**Abstract**. Over the past eight years, we have worked collaboratively with elementary and middle school students to help them design their own educational computer games. Although the benefits of "learning by designing" are becoming well documented in the literature, another question has emerged: Do children, *other than those who designed the educational computer games*, find these games motivating? This question was the focus of this study and was investigated by giving another classroom of middle school students the opportunity to play these educational games while quantitatively documenting their perceptions and play behavior. This study also documented the characteristics of the games that children found particularly compelling and we compare them to those game design characteristics stressed in the literature. This study also explored the reasons behind the children's play behaviors and critiques through qualitative interviews. These students took their role of "critics" seriously and critiqued the games in sophisticated and coherent ways. Important game characteristics identified by the children included the following: 1) storyline or context; 2) challenge; 3) competitive affordances, especially those which promoted social interaction. Interestingly, two game characteristics touted in the literature were *not* found to be important to these children: 1) integration of game's storyline and educational content; and 2) the game's production values.

Electronic gaming has become an integral part of the everyday lives of children and they devote much time to gaming activities (Provenzo, 1991; Turkle, 1995). Children also spend tremendous amounts of time in school. Unfortunately, children often find school work uninteresting and disconnected from their lives which results in poor motivation. Student motivation continues to be one of the most difficult aspects of teaching (Ames, 1992; Ruenzel, 2000). We have long wondered if there is a way to merge the natural interests of children outside of school with the demands placed on them inside school.

One effort to do so is Project KID DESIGNER, in which elementary and middle school children have been given the opportunity and support to design their own computer games to teach classroom content (Rieber, Luke, & Smith, 1998; Rieber et al., 1998, December). While schools have typically resorted to extrinsic motivating factors, including reward systems, praise and punishments, Project KID DESIGNER has relied on the students' intrinsic motivation based on their personal goals, objectives and curiosities. Project KID DESIGNER has also freed the children from external criteria for how their products would be judged. Instead, the children generated their own criteria, though negotiated in design teams, for what makes a superior game.

So far, the focus of Project KID DESIGNER has been on the role of the "child as designer" of computer projects, consistent with the aims of constructionism (Kafai & Resnick, 1996). An interesting approach for determining what children would find as an authentic computer project is to look at what children do with computers when given the freedom to choose. As Papert notes, a good computer project "must have roots in the culture of children; it must feel to a kid like it is connected with the kinds of things that kids do, and in particular with the kinds of things that kids do with computers" (1996, p. 114). Papert contends that the two best established examples of what children do with computers are playing games and surfing the Internet. Consequently, Papert feels it is "quite respectful to work with kids on understanding these activities and looking for ways to make them richer in one way or another" (1996, p. 114). This aptly sums up much of our work with Project KID DESIGNER.

The historical and philosophical roots of Project KID DESIGNER are founded on principles closely associated with constructionism (Harel & Papert, 1991; Kafai & Resnick, 1996; Papert, 1991; Rieber, 1996; Rieber, Smith, & Noah, 1998). Central to constructionism is the belief that learning is enhanced "…in a context where the learner is consciously engaged in constructing a public entity, whether it's a sand castle on the beach or a theory of the universe" (Papert, 1991, p. 1). The games developed for Project KID DESIGNER by elementary and middle school students over the past eight years were the result of design activities to help them learn more about the content of the games in an authentic and motivating way. However, the extent to which these artifacts are considered as authentic and worthwhile resources for *other* students has not been investigated. This is important because an underlying assumption of constructionism is that the design activities have social relevance for *all* students in the setting. Products are designed with the expectation that they will be shared with other members of the community. In the case of Project KID DESIGNER, the community consists of other students. As Kafai (1996) contends, when learners design their shared artifacts, they are in "continuous dialogue with their own ideas and with the ideas of intended users..." (p. 72). Thus, the games reflect not only the designers' ideas but also a shared meaning among designers and users.

So far, Project KID DESIGNER has produced 15 games suitable for playing by children other than the designers. We have found that engaging in constructionist game design activities can be motivating for the designers. A natural question has emerged: Do children, *other than those who designed the educational computer games*, find these games motivating? This question was the focus of this study and was investigated by giving another classroom of middle school students the opportunity to play these educational games while documenting their perceptions and play behavior.

A second goal of the study was to document the characteristics of the games that children found particularly compelling. In other words, when given the role of "children as critics", what features of non-commercial games (again, those designed by other children) do middle school students feel are exemplary and noteworthy? Subsequently, how do these identified characteristics compare to those characteristics of good gaming and intrinsic motivation as established in the literature (e.g. Malone & Lepper, 1987)? Furthermore, this study explored the reasons behind the children's play behaviors and critiques through qualitative interviews.

Of course, questions related to the motivational appeal of materials and resources given to students by adults are not new. The study of intrinsic motivation (Cameron & Pierce, 1996; Lepper, Keavney, & Drake, 1996; Ryan & Deci, 1996) and its relationship to game design (Dempsey, Lucassen, Gilley, & Rasmussen, 1993-1994; Malone, 1981; Malone & Lepper, 1987) have been favorites among researchers. However, attempts to bridge these two literatures are sorely lacking. An interesting aspect of doing so is the degree to which adult perspectives actually correlate with those of children. For example, little attempt has been made to correlate motivational constructs, such as Turner and Paris' (1995) six C's of motivation (choice, challenge, control, collaboration, constructive comprehension and consequences) to actual game playing behaviors of children. Similarly, some of the hallmarks of good educational game design, such as integrating the educational content with the game context, often fly in the face of commercial success. *Math Blasters*, one of the all-time best selling educational titles, largely fails in the integration of game and content. We believe the means of resolving this conflicting information resides in understanding better the views of the children who play these games.

## QUANTITATIVE ANALYSIS

A variety of data sources were used in this study. First, quantitative data were collected as part of a computer management system that recorded and tracked individual participant game playing activity, such as game selection, order of selection, game playing duration, and survey data consisting of game ratings. Qualitative data were also collected from a subset of the participants in the form of follow-up interviews using a semi-structured interview protocol. The quantitative methods and results of this study will be reported first, followed by the qualitative methods and results.

*Participants*

Participants were 30 children (12 girls and 18 boys) in two sixth-grade classes at a public, rural middle school in the southeastern United States. Twenty-two of the participants were students in a science class, while the remaining eight participants were students in a Title I reading class. Both classes were taught by the same teacher, who supervised all game-exploration sessions. All participants had previous experience using computers.

*Procedures*

For three weeks participants explored and evaluated the 14 computer games[1] that were designed by other students over the past eight years and one game designed by an adult (a member of the research team) called *Mineshaft*, a game of estimation (as illustrated in Figure 1). This game, constructed with the same look and feel as the other games designed by children, was included in order to explore whether the children would perceive differences in it, even though they did not find out until the end of the project that it was designed by an adult. Different versions of *Mineshaft* have also been used with hundreds of children over the years, so there is some external validity as to its motivation for children of this age, hence it provides a good external benchmark for comparison purposes to the other games.

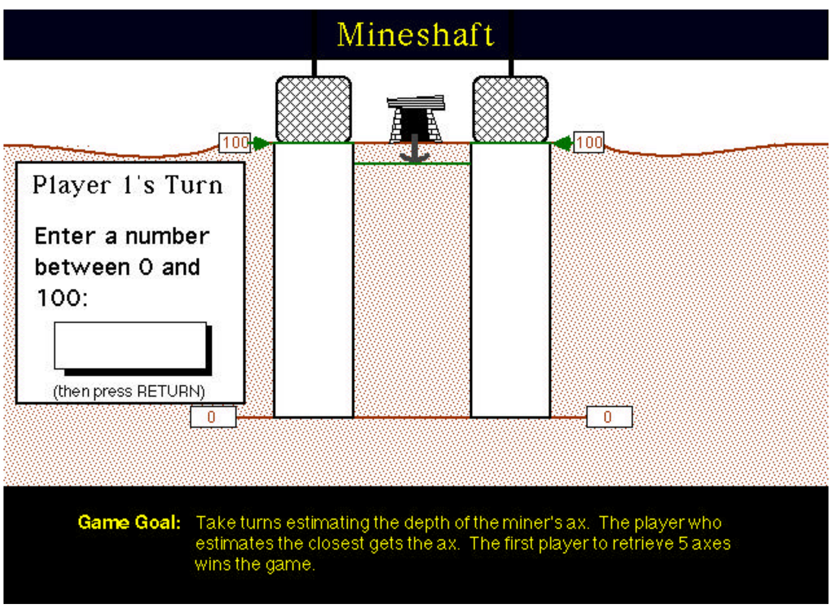


*Figure 1*. A screen snapshot of *Mineshaft*. Each player inputs a number to estimate the level at which the miner's ax is located. The player with the closest estimate "wins" the ax, which is transported to the surface and dumped onto that player's side of the screen. The first player to successfully retrieve 5 axes wins the game.

The participants accessed the games via a computer management system specifically written for this study. The computer management system presented a menu of the 15 games to the participants and collected both quantitative as the participants explored and played with the games. We also collected qualitative data in the form of observations and follow-up interviews. (These data are presented in a later section of this paper.)

The computer management system and games were installed on four computers in the teacher's classroom as well as on at least twenty computers in the school's computer lab. On two occasions participants evaluated the games in the computer lab; otherwise, game-exploration sessions were held in the classroom.

After the games and computer management system were installed and before data collection began, two of the researchers conducted a 2-day orientation to the project. The purpose of the orientation was to acquaint the participants with the purpose of the project and to outline the project procedures. During the first day of orientation, the researchers briefly demonstrated each of the 15 games and responded to children's questions about the games and about the research project. The second day of orientation was also the first day of data collection, as children began to explore the games on their own. We were available in case the children or teacher had additional questions about the project procedures or encountered problems with the software. No problems were observed.

*Data Collection*

*Game-Exploration Sessions and Surveys*. During the game-exploration sessions, each student freely chose from a menu of 15 games as illustrated in Figure 2. As soon as a game was chosen, the computer management system logged the name of the game and then launched the game. After the student finished playing the game, the computer management system recorded the amount of time, in seconds, that the student spent exploring the game, then returned the student to the game menu. Then the student was free to choose again from the menu of 15 games.

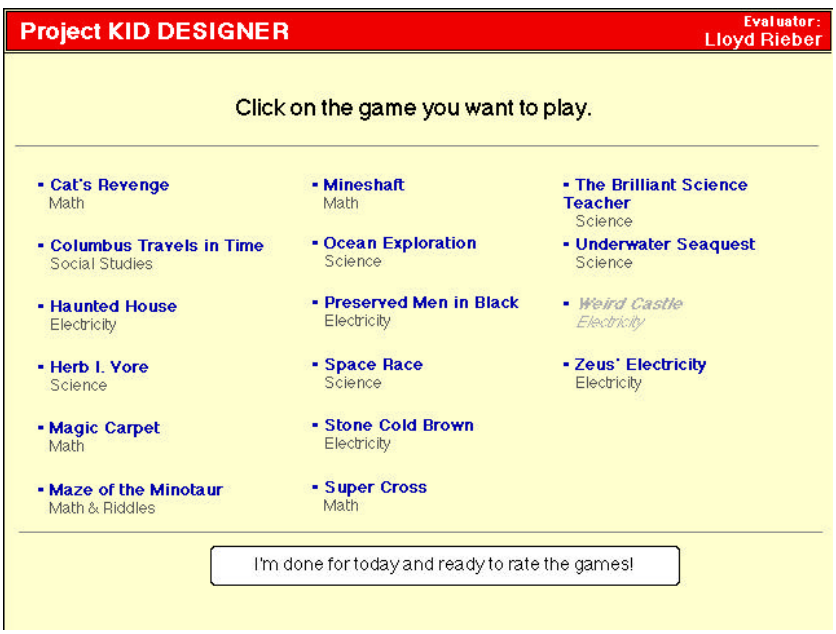


*Figure 2*. The menu screen of the computer management system. Participants were able to choose to play any of the games available as often as they wished, in any order that they wished, and for as long as they wished (though given the time constraints of a typical school day). When they chose to stop playing (by clicking on the "I'm done for today…" button), they were then prompted to rate the games played during the session as well as those played so far during the project.

When the student decided not to play any more games, the session ended and the computer management system presented a brief exit survey to the student. (Examples of the various screens of the exit survey are illustrated in Figures 3, 4, and 5.)

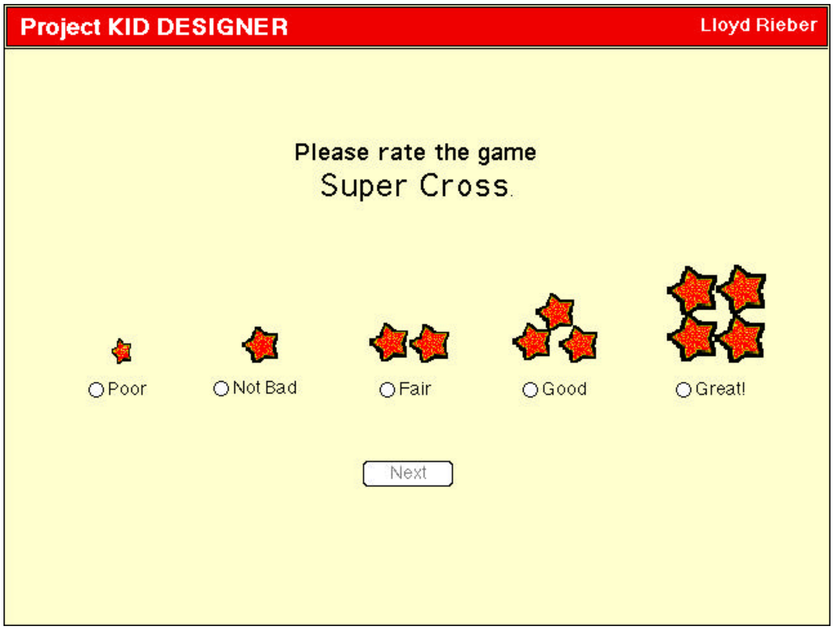


*Figure 3*. At the conclusion of the session, participant were asked to rate each of the games they played during the session.


*Figure 4*. After each of the games played during the session were rated individually, participants were then asked to choose their favorite game (if any) played that session from a context-sensitive screen (i.e. only those choices of games actually played during the session were active).


*Figure 5*. After participants chose their favorite game (if any) for the session, they were then asked to vote for up to 3 games they thought were the best from a list of all the games *they had played* throughout the project using a context-sensitive screen (i.e. using a database of their individual game playing information, only those choices of games actually played so far during the project were active).

The survey included the names of the games explored during that session along with the following three questions:

1. Please rate the game [game name]. (Ratings ranged from 1 – 5: 1 = poor; 2 = not bad; 3 = fair; 4 = good; and 5 = great)
2. Of the following games you played during this session, which was your favorite?
3. Of all the games you have played so far during this project, vote for up to 3 games you think are the best.

There were no preset dates for the game-exploration sessions. The participating teacher allowed the students to evaluate the games frequently as opportunities during a typical school day permitted throughout the 3 weeks. This was accomplished using computers in both the classroom and in the lab. Researchers only observed participants as they played with and evaluated the games in the computer lab.

*Final Survey***.** Upon the conclusion of the 3 weeks during which the participants were allowed to play the games, the researchers met with each class separately to give the participants one final opportunity to vote for their top 3 games from all of the 15 games. This voting was administered as a paper-and-pencil survey.

## QUANTITATIVE RESULTS

Of the 15 games, five distinct groups emerged from the participants' final ratings. One game, *SuperCross* (illustrated in Figure 6), emerged as the top game, gaining 19 "top 3" votes. The second group consisted of two games, *Mineshaft* and *Stone Cold Brown*, gaining 16 and 14 top 3 votes respectively. The third group consisted of two games, *Cat's Revenge* and *Magic Carpet*, gaining 10 and 8 top 3 votes respectively. The fourth group consisted of five games gaining top 3 votes ranging from five to three. The final group consisted of five games, two of which gained only one top 3 vote each and the other three did not gain any top 3 votes.

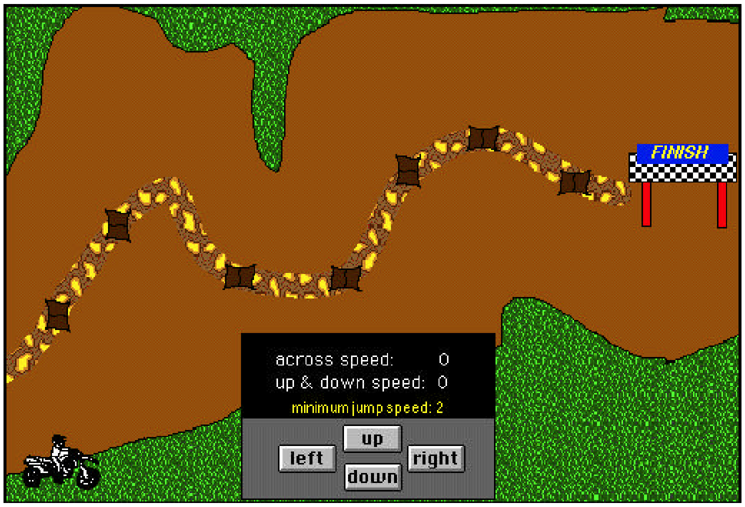


*Figure 6*. A screen snapshot of SuperCross, a math game in which players have to maneuver their motorbike to the finish line. If the bike's speed is too slow as it goes over one of the "jumps", a math problem appears. If the player answers correctly, the player continues; if the player answers incorrectly, the bike is returned to the starting position to try again. After reaching the finish line, the player is presented with a new race course.

These ratings were very consistent with the children's game playing behavior, as evidenced by the total amount of time they actually spent playing the games. *SuperCross* was played for a total of 524 minutes (compiled across all of the participants over three weeks) and *Mineshaft* was played for a total of 405 minutes. The remaining games were played for a total amount of time that matched the ordinal ranking of ratings with few exceptions ranging from 309 minutes to 43 minutes. In other words, the participants' actions accurately mirrored their ratings.

These results largely did not differ by gender. This is interesting because there is documentation that several of the games were designed along gender lines, that is, several games were designed by teams consisting of all boys and all girls. *SuperCross* is an example. It was designed by a team of all boys on a theme that appears on the surface to be more male-related. However, ratings of *SuperCross* by boys and girls were quite similar: boys cast 24% of their top 3 votes, and girls cast 19%, for it. Similarly, *Cat's Revenge* was designed by an all-girl team, yet boys cast 14% of their top 3 votes, and girls cast 8% of their top 3 votes, for it. However, another game designed by an all-girl team, *Magic Carpet*, involved the traditional storyline of a princess being rescued by a prince, resulting in a likewise rating traditionally across gender: girls cast 17% of their top 3 votes for it in comparison to only 4% of the top 3 votes by the boys.

These quantitative data are particularly interesting given the nature of the games that surfaced as the most popular. For example, from an educational point of view, *SuperCross* and *Mineshaft* were designed in completely contrary ways: *SuperCross* presents mathematics in a way that is completely external or separate from the game element, whereas *Mineshaft* presents mathematics and the game in an integrated form. Clearly, these data show that the degree to which educational content and the game are integrated fails to serve as a useful design criterion in predicting students' critiques, despite its primacy as a benchmark in the educational game design literature. How does one make sense of these data? Qualitative interviews were designed and conducted with this expressed purpose in mind.

## QUALITATIVE ANALYSIS

Upon completion of the quantitative data collection, 12 of the 30 participants were interviewed in a 15-minute, one-on-one, semi-structured format. Six participants from each class were chosen by the teacher to be interviewed. The following themes were explored: 1) What makes a game fun? 2) What are characteristics of good games? 3) What are characteristics of poor games? and 4) What subject matter learning occurred as a result of playing the game? They were also asked to describe characteristics of the games they felt were especially important in the best games played.

## QUALITATIVE RESULTS

Several themes emerged from the interviews. First, the game's context, or storyline, was an important influence in the children's critique. Of the top three games, these included, respectively, motorcycle racing (*SuperCross*), mining (*Mineshaft*), and "cops and robbers" (*Stone Cold Brown*). In the interviews most of the participants admitted that they did not read the rules before playing the games. Thus, participants seemed to prefer games that had a familiar or meaningful context or narrative. *SuperCross* is similar in function and aesthetics to commercial arcade video games. The same can be said about the cops and robbers storyline of *Stone Cold Brown*. Mining, on the other hand, was not a familiar context. Yet, the rules for playing the game were closely tied with the context, making the context more meaningful.

Second, the participants preferred games which provided competition. Of the 15 games, only one, *Mineshaft*, met this characteristic adequately, and the interviews confirmed this influenced its popularity. The value of competition is probably best understood by the social needs of middle school students. For example, participants reported that the games were often discussed outside of class. This fact may also shed some light on the gender results. For example, part of the popularity of some of the games, especially *SuperCross*, appeared to be based in part on the social dynamics of middle school. The high ratings of *SuperCross* may have had a "snow ball" effect — popularity often begets popularity with children of this age group. For example, Marie[2] commented on just how much her friends had talked about the games outside of class: "Yeah, I heard a lot of people talk about *SuperCross*. I think that was the majority's favorite. And they, and I know a lot of them liked that *Stone Cold Brown* where you could get blown up. A lot of the guys always talked about that one."

Interestingly, participants did *not* focus on a game's production values. In the interviews, participants consistently stated that although they like the high-quality graphics and sound of commercial video games, the amateur-like quality of these children-designed games was not a problem nor an important factor in their critiques. This runs contrary to the popular myth among adults that children are seduced by the "mind numbing" visual and aural effects of video games. If anything, these participants appreciated the fact that their peers had been able to design fairly interesting interactive computer games.

Another way to look at the qualitative data is to compare it to some of the well-entrenched design literature related to motivation, especially intrinsic motivation, since it most closely relates to the free choice procedures used in this study. Intrinsically motivated learning is defined as a situation when a learner is interested in the learning activity itself and does not engage in the activity for some external reward or fear of punishment (Brophy, 1998; Csikszentmihalyi, 1985; Lepper & Chabay, 1985; Malone & Lepper, 1987). Many researchers have proposed constructs that could be integrated into an instructional activity or game in order to improve a learner's intrinsic motivation for playing. A review of the literature has revealed, but is not limited to, some of the following strategies: Challenge, Curiosity, Control, Fantasy, Personalization, Cooperation, Competition, and Recognition (Brophy, 1987; Brophy, 1998; Cordova & Lepper, 1996; Csikszentmihalyi, 1985; Deci, Betley, Kahle, Abrams, & Porac, 1981; Keller, 1983; Lepper & Malone, 1987; Malone & Lepper, 1987). The remainder of this section will discuss a few of these constructs that most closely matched the goals and outcomes of this study.

*Challenge*. Challenge refers to maintaining an optimal level of difficulty in the instructional task being attempted. By maintaining an optimal level of challenge—not too difficult, not too simple—students are constantly engaged in the activity as they are able to achieve success when applying reasonable effort (Brophy, 1998; Csikszentmihalyi, 1985; Malone & Lepper, 1987). When an activity is too easy, the learner may find it monotonous; when the activity is too hard, the learner is frustrated. In either case, the learner may disengage from the task (Brophy, 1987).

For example, Marie commented that she enjoyed *SuperCross*: "And it was really, like, challenging. You had a goal to get to."

Angela commented on the importance of optimizing challenge in *Mineshaft*: "It depends on, like, what level you wanted it on. Like most of these like had two or three levels, like low, medium, and high. And you could like, in *Mineshaft*, you could put it at like a million, and like negative a million and you had to guess between that. So, you could make it really hard."

Sam commented on the importance of challenge in *Mineshaft*, especially in the way in which it helped him in the process of estimating: "It was kind of challenging. It kind of makes you think these certain thoughts that it's this number or that number."

*Curiosity*. Arousing the curiosity of learners is a simple method for improving their intrinsic motivation that can be accomplished by simply including elements that will arouse the curiosity of a learner in an instructional game (Brophy, 1998; Keller, 1983; Malone & Lepper, 1987). Examples could include placing an element that alludes to popular and contemporary culture in the game. The only exceptions or examples of bad elements that satisfy curiosity would be themes or plot that interferes with the instructionally relevant portions of the games. In this study, the theme of curiosity was explored, as students were introduced to various storylines and plots in the games that were constructed by other students.

*Control*. Providing users with a sense of control gives them a sense of autonomy where they feel that they are in charge of what they are constructing. Studies have shown that when users are given choices in the activity, they show better performance and persistence in that activity (Brophy, 1987; Cordova & Lepper, 1996; Malone & Lepper, 1987).

Ed commented on the fact that he liked *Mineshaft* because he likes math and also because he is able to control aspects of the game's parameters, also allowing him to optimize the challenge: "Yeah, I like math. I like the estimating, too. And I like how you could set the number—the highest number and the lowest number. So you could have a really hard one like 1000 and 0. Or, one time I had –1 and 0 and it was really hard. So you could set your, um, you could set what you had to guess between. And that was one of the best things about the game….so you could make it really hard or really easy."

*Fantasy*. Adding a fantasy element to the game is a simple and effective way to improve a learner's intrinsic motivation (Malone & Lepper, 1987; Parker & Lepper, 1987). Fantasies can not only arouse the learner's curiosity, as stated above, but can provide a context to a learning activity where the learner can see a relevance to the topic being presented, and the relevance can further motivate the learner (Keller, 1983a). As already noted, the game's context or storyline seemed to be an important influence on the children's critiques.

*Cooperation*. A review of the literature has shown that there could possibly be many benefits to having cooperative interaction in a game playing experience. Cooperation can also improve intrinsic motivation for the following reasons: (1) peer comments and ideas can spark further interest in other students, (2) high achievement peers can provide supportive models for other students to emulate (3) peers provide a gauge for other students to measure their achievement, and (4) when there is an obligation to a group goal, individual persistence is enhanced (Paris & Turner, 1994). Kafai and Harel (1993) found that collaboration plays a role in constructing software projects. In these projects, students' collaboration served to assist students in developing their ideas together; for example, when one student did not need assistance but served as an example to others, or a student needed assistance in developing an idea and looked to others for ideas (Kafai & Harel, 1993).

Marie commented on the social aspects of playing the games and learning subject matter from the games: "Well, there was this one, and it had a bunch of science questions. I can't remember what it was. But they were *hard* and I, actually, after I played it a lot, I've always got friends, I got some help from my friends and so I could learn those questions."

The social side of cooperation is reflect in Susan's definition of fun: "Hanging out with friends. Being able to laugh. Having a good time."

*Competition*. Perhaps one of the most obvious motivational embellishments in the design and playing of games is competition. Competition takes place when different individuals strive for the same goal in a situation where only one can achieve it. Much of the literature pertaining to the use of competitive strategies in the classroom has shown that many drawbacks are involved (Ames & Ames, 1978; Ames & Ames, 1981; Ames, Ames, & Felker, 1977; Deci et al., 1981; Harris & Covington, 1993; Kohn, 1991). These drawbacks are primarily focused around the students who are not the winners in a competitive situation.

Thomas commented on the interesting technique that several students used to introduce competition into the game *SuperCross,* even though person-to-person competition was not part of its original design:

> Thomas: "They'll be like on a different computer, but we'll start at the same time. And we'll race against to see who's the fastest."
> Interviewer: "And so, what makes it fun with two different players at the same time?"
> Thomas: "Because it challenges you to answer the questions faster, use your brain faster, and like move fast through the game. Makes your technique better each time you play."

Thomas also commented that he liked *Mineshaft* for the way he was able to compete against a friend, while at the same time obviously learning some "deep" strategies for being successful at the game: "*Mineshaft,* now I liked it because it was two players, and you had to guess. And I would always race with my friend. We used to pick numbers, and then whoever is closest to it, gets the ax. You have to get five axes to win. Either him or me always ends up winning. It's fun. We have to get our guessing ability more. When you see half the bar, it goes to the half point and you remember it's five. If it goes back near that spot, then you be like it's the half point so it's not all the way on half point, so you will be able to guess correctly, accurately."

On the other hand, Ed related the importance of challenge to some of the negative aspects of competition while competing against another player with *Mineshaft*: "Because you got to challenge the other person. It was a 2 player game and you can do it together. And it's funner when you do it with another person. And then you have bragging rights against them. You can kind of taunt them all through the year. Well, not really taunt them. You get to play around with them. So it's something you remember. It's like "I beat you at that!" And they're like, "OK….yeah." It's just funner to play against each other."

*Achievement*. Finally, success in playing a game, not surprisingly, contributed to a person's perception of the game's design. For example, consider the comments of Jessica as she reflected on the importance of success at playing a game in her critique of the games:

> Interviewer: "Let's see. The first time you played Super Cross, you gave it a 1. Why? [pause] You didn't like it at first?
> Jessica: "No, 'cause I couldn't beat it."
> Interviewer: "So you gave it a low rating? But the second time you played it, you gave it a 5. What happened between the first time and the second time?"
> Jessica: "I got halfway through level 3."

## DISCUSSION

The first research question of this study explored whether educational computer games designed by elementary and middle school students are perceived as fun, interesting, and relevant to other students. The results of this study showed that although these participants are sophisticated and demanding computer game players, they found the best of these games to be worth their time. The second research question attempted to document the characteristics of the games that children found particularly compelling. The data from this study points to some very interesting themes.

First, children's game playing behavior was very consistent with their critiques. That is, those games that they rated most highly were also those games which they played the most. Second, the children's critiques were complex, sophisticated, and *coherent*. Games that were considered the most fun and interesting to play seemed to have the following commonalties: 1) strong game context or storyline; 2) challenge; 3) competitive affordances; and 4) student preference for the game's educational subject matter. Some of these, such as the importance of challenge, is consistent with the literature. However, there was little support for time-honored characteristics such as the need to integrate the content with the game. Instead, the children were perfectly content with games that, from the adult perspective, "sugar coated" educational content with an interesting game context.

However, the children's emphasis of the importance of the game's context or storyline over production values suggests that these participants recognized the importance of a game's "deep structure" over that of surface features such as graphics and sound. This is consistent with the documented relationship between good stories and good games (Schank, 1990). Furthermore, in a study investigating gender differences in children's construction of educational games, Kafai (1996) found that narrative was a popular element in games designed by both boys and girls. She speculates that students used narrative as a "glue" for connecting scenes in the games with the educational content. Based on the findings of our study, one could postulate that the narrative also provided shared meaning between the designer and the user. The competitive affordances were evident either in the game's design (such as the two player feature of *Mineshaft*), or in creative adaptations of the game by participants. For example, many participants sitting side-by-side would boot up *SuperCross* on their respective and separate computers, then start the game simultaneously to see who would get to the finish line first. Follow-up interviews indicated that the social consequences of competitive game playing was an important consideration for these participants. Participants enjoyed the social connectivity afforded by a few of the games, but were careful not to allow competition to threaten their social standing. Finally, interviews with participants indicated that their critiques were also influenced by the educational subject matter. Games which focused on school subjects they liked were rated more positively. The participants clearly understood that the opportunity to play these games was not meant as mere entertainment, but rather as a creative way to get some practice with the content.

Probably the most important outcome of this research is the importance of the degree to which gaming influences and supports social relationships among the players and their peers. Indeed, one could argue that the design elements of narrative, competition, and challenge of which the children spoke all relate in some way back to the social dynamics of their daily relationships. Of course, individualistic attributes are involved here as well, but the social needs of the children were articulated very consistently throughout the interviews. Relatedly, other data from the interviews also showed how gaming was a bridge between school and home, again speaking to the importance of the children's social networks.

Beyond the results related to educational computer game design, the consistency of the participants' responses, both quantitative and qualitative, reveal that middle school students are thoughtful critics when given time, opportunity, resources, and appropriate venues for recording their perceptions and beliefs. The procedures and results of this study offer promise in developing additional strategies for taking advantage of students' opinions and ideas, something anyone interested in developing interactive multimedia for education should consider.

In conclusion, the views of children and adults often clash when it comes to what is important in the design of educational activities, especially activities as central to students' lives as games. This study points to the sophistication, seriousness, and usefulness of children's views on software evaluation. One other interesting fact surfaced during the interviews. Despite the prevalence of computer and video games in the everyday lives of these children, it was interesting to note that during the interviews many children also mentioned their enjoyment for playing traditional games, such as *Monopoly* and *Yahtzee!*. Although not a focus of this study, this also points to the social connectivity of gaming. It is likely these children learned to play these traditional games in the same manner most of us learned them, through playing them with family and (usually) older members of our communities. Games are ways in which we connect socially to each other. Such social connectivity appears likewise to be an important part of the educational gaming experience.

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**FOOTNOTES**

[1]One of the 15 games produced during Project KID DESIGNER, *Weird Castle*, had technical difficulties early in the implementation of this research project, consequently, it was removed from the project.

[2]Pseudonyms are used for all of the participants quoted in this paper.