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MOOSE Goes to School: A Comparison of Three Classrooms Using a CSCL Environment

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Abstract

MOOSE Crossing is a text-based virtual reality environment (or "MUD") designed to give children eight to thirteen years old a meaningful context for learning reading, writing, and computer programming. It is used from home, in after-school programs, and increasingly as an in-school activity. To date, it has been used in five classrooms. This paper compares its use in three of those classrooms, and analyzes factors that made use of MOOSE Crossing more and less successful in each of these contexts. Issues highlighted include access to computers, existence of peer experts, free-form versus structured activity, and school atmosphere.

1. Introduction

What factors make Computer-Supported Collaborative Learning (CSCL) (Koschmann 1996) environments succeed in classroom use? What factors make them fail? The success of a CSCL environment depends not just on the software, but on the context in which that software is used. This paper compares the use of one CSCL environment, MOOSE Crossing, in three classrooms.

MOOSE Crossing's effectiveness as a learning environment is evaluated in (Bruckman 97). This paper highlights issues which have emerged from its classroom use.

At the time of this writing, MOOSE Crossing has been used as an organized activity in five classrooms in four schools, located in three states. We refer to these classes as California Public, Minnesota Private, Minnesota Public Advanced Work, Minnesota Public Title I, and Massachusetts Public. Participants were self-selected—the teachers of each of these classrooms heard about MOOSE Crossing (through friends, through parents, or on the net), and chose to try it with their classes. Too many factors vary among these classes to warrant a formal comparison. However, a case-study analysis reveals a number of educationally significant features.

For the purposes of this paper, we have chosen to focus on the three most similar classes. The other two classes, Minnesota Private and Minnesota Public Title I, fall into somewhat different categories. Students at Minnesota Private have not made significant progress with MOOSE Crossing, because they have extremely limited time to participate. The class meets for only half an hour once per week, during recess. Students in the Title I class at Minnesota Public have extreme difficulty with basic reading skills, and some have been diagnosed as learning disabled. It's difficult to compare their experiences to those of the other classes. The three remaining classes—California Public, Minnesota Public Advanced Work, and Massachusetts Public—are more comparable.

While MOOSE Crossing is a network-based learning environment which facilitates collaboration within the online environment, the details of its implementation in a particular classroom are still of central significance to the activity's success. Face-to-face collaboration within a classroom and collaboration online are complementary (Bruckman 1997). This paper will focus in particular on issues of access, existence of peer experts, free-form versus structured activity, and atmosphere.

1.1 Background: The MOOSE Crossing Project

MOOSE Crossing is a text-based virtual reality environment (or "MUD") designed to be a constructionist learning environment for children eight to thirteen. MOOSE Crossing is distinguished from other MUDs for kids in the new technology developed and the strength of its underlying educational philosophy. It includes a new programming language (MOOSE) and client interface (MacMOOSE) designed to make it easier for children to learn to program (Bruckman 1997). On MOOSE Crossing, children construct a virtual world together, making new places and objects that have behaviors. They also construct fanciful personas for themselves. For example, a child named Bill from Minnesota Public describes his MOOSE Crossing character as:

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The wolf from "Little Red Riding Hood" and "Three Little Pigs."
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Bill made this room:

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Bill's Kitchen
You see pig wallpaper surrounding you. Suddenly, you hear squeals from within the oven. They say: " Hey, is it me, or is it HOT in here? I don't think it's a sauna, because saunas aren't this dark and small!
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Bill is autistic but very bright, and is a member of the advanced work class at Minnesota Public. Bill programmed a pet dog named Bo who follows him around the virtual world. MOOSE Crossing is an object-oriented programming environment. Bill created Bo by making an object which inherits from Generic Dog. The "parent object" gives Bo the ability to be petted or kicked, and to follow its master around the virtual world. Bill then added two programs to Bo of his own:

```
--> kiss Bo
Bo says, 'EEEEEEw!
    Grooosssss!'

--> juggle Bo
Bo juggles water balloons,
    but drops one.
Bo says, 'Oops!  Well,
    nobody's perfect!'
```

Bo's code is very simple:

```
on kiss this
  say "EEEEEEw!  Grooosssss!"
end

on juggle this
  emote "juggles water
      balloons, but drops
      one."
  say "Oops!  Well, nobody's
      perfect!"
end
```

While many CSCL environments support children sharing ideas online, MOOSE Crossing allows them to work on shared projects, learning through designing the virtual world together. The constructionist philosophy of education argues that learning by working on personally meaningful projects is better than learning by being told (Papert 1991). Our notion of "success" of the learning environment is shaped by this philosophy: children's learning experiences are successful when they are engaged in working on substantial projects which challenge their skills and provide them with opportunities for creative expression.

Most constructionist learning environments focus on children working on individual projects. MOOSE Crossing puts special emphasis on community support for constructionist learning, and the essential role community members play in the learning process. Children on MOOSE Crossing motivate and support one another's learning experiences. They make things to share with one another, and take pride in helping one another with technical problems. They provide one another with emotional as well as technical support for the learning process, and serve as an appreciative audience for completed work. The community is a ready source not just of project models for children to learn from, but also of role models for them to emulate. The networked environment provides a context for children to support one another's progress in learning reading, writing, and computer programming (Bruckman 1997).

MOOSE Crossing was originally designed to be used from home and after-school programs. To our surprise, it has proved particularly popular for classroom use.

Currently, 40% of participants connect from school, compared to 45% from home and 15% from after-school programs. In-school users are the fastest growing segment of the population, and will soon become the largest group. In our attempts to recruit new members for MOOSE Crossing, we have discovered that there are few after-school programs where children can use computers connected to the Internet. In contrast, many schools are getting wired for Internet access. Once net connections are established, however, many teachers find a shortage of quality software tools and curricula to make use of them. Teachers who prefer a constructionist approach are eager to try MOOSE Crossing with their classes.

2. Three Classrooms

The classes presented here vary along many dimensions, including the philosophy of the school, the ages and abilities of the students, the general accessibility of computers to the students, the length of scheduled MOOSE Crossing sessions, and organization of class sessions. Table 1 summarizes a number of these factors.

To varying degrees, we talked with students in each of these classes online, helping them with their projects over the course of the school year. Towards the end of the year, we visited each of these schools in person. Before each classroom visit, we reviewed the objects created by the students we were about to meet. During the visit, we observed the students while they were using MOOSE Crossing, asked them questions as they worked, and helped them with their ongoing projects. We also talked with their teachers, asking about the kids' experiences using MOOSE Crossing.

After each visit, we took detailed field notes of what we experienced. We also asked students and teachers questions, both on MOOSE Crossing and via email. Our observations are supplemented by analysis of the artifacts the children have created, and log files of their interactions online (recorded with permission from both parents and children.) While what is presented here is not detailed enough to qualify as a "thick description" (Geertz 1973), our observations are supported by a significant body of data[1].

[1]A more detailed account of learning on MOOSE Crossing appears in (Bruckman 1997).

2.1 California Public

The class from California Public is a combined 4th and 5th grade class of approximately sixty students, with two teachers and a teacher's aide. The classroom itself is large, and is divided in half by a large archway. Computers are scattered throughout the room in a clever setup: the monitors are mounted at an angle below clear Plexiglas desktops so that students can alternate between using the desks as tables and using the computer. Keyboards are tucked away on trays under the desks. There is one computer for every two students. Throughout the day the children are divided into two or three groups, and often sit on a large rug on the floor to receive lessons from one of the teachers or sit at the computer desks to work on an assignment.

The class divides into thirds on Fridays, each group of twenty using a different piece of educational software for a period of an hour and a half. One of the two teachers, who we'll call Mrs. Jay[2], leads all of the computer sessions while her teaching partner works with the rest children on the other side of the classroom. One of these groups has been using MOOSE Crossing since October 1996; we visited in April 1997. In addition to the scheduled hour and a half session on Fridays, the kids have access to MOOSE Crossing during their free time, including a half hour during recess and 45 minutes at lunchtime. The kids are permitted to log on when they finish their classwork ahead of their peers, though these are typically only five or ten minute intervals. Mrs. Jay also lets students use the computers after school. The students regularly take advantage of the opportunity to use the computers during their free time.

The students in this class have done by far the most with MOOSE Crossing as compared with other classes we visited. Here every child has created his or her own room, and at least one pet. Many have a host of other objects. Everyone has written at least a simple script, and some have done quite a bit more programming, mostly things they had learned during recess and lunch time. Several of the kids who log in regularly during free time have begun to assume the role

[2]We have chosen to change the names of all participants in this study, to protect the children's privacy. We regret that this prevents us from properly crediting teachers participating for their significant professional contributions to this research.

of local experts in the classroom, and frequently help other children with their projects during the Friday class sessions.

Location	California	Massachusetts	Minnesota
Type	Public	Public	Public
Grade	4th-5th	3rd-4th	5th-6th
Scheduled Sessions	1.5 hours/week	45 minutes/6 days	1.5 hours/week
Date Began	October 96	March 97	December 96
Average Commands Typed Per Student	3649	695	1245
Average Objects Owned Per Student	33	11	15
Average Scripts Written Per Student	10	4 (Many of these were written by one student, Sara.)	2
Computer Location	In classroom	Computer room in school; one computer in classroom	Computer room across street at university
Session Focus	MOOSE class project	Free choice	MOOSE
Free Time Computer Access?	Yes	For one student at a time	No
Number of Children	22	15	14
Adults Assisting	1 teacher	1 teacher, 1 parent (occasionally)	1 university professor

Table 1: MOOSE Schools

Mrs. Jay tells us that the girls and boys like MOOSE Crossing equally, which she does not think is the case for the other two software packages that the Friday groups use. In those activities, the girls are not as interested. Although Mrs. Jay doesn't have detailed experience with MOOSE Crossing, she is extremely experienced in using technology in the classroom..

A few months after they first started using MOOSE Crossing, the kids were studying the notion of "survival" in school. Mrs. Jay had the idea of making a sinking ship on MOOSE Crossing, complete with lifeboats, items on the ship that can be used as survival tools, and a desert island to use them on. The kids enthusiastically began work on this class project, which became the focus of their Friday sessions. Every child researched and described his or her assigned room on the ship, including rooms like the Officer's Quarters, Galley, Cargo Room, Engine Room, and First Class Cabin. A CD ROM about the Titanic provided one source of data. The class drew a map on paper of the ship's layout. At the time of our visit, they were in the process of connecting their rooms according to the map. One child wrote a program that makes the ship sink whenever someone wanders into the Cargo Room; the script changes each of the ship's rooms from its "normal" description to its "sinking" one. The class project was well chosen. As Oday et al note, the activity chosen needs to work well within the affordances of a MUD environment (Oday 97).

The kids are clearly enthusiastic about their MOOSE Crossing time; they begin the session by excitedly planning the day's work with Mrs. Jay, then break up to work on their own computers. Throughout the session kids get up to help one another with problems, or to coordinate a joint project, such as connecting two rooms in the ship. Mrs. Jay helps kids with questions as well, often researching the answer along with the student.

2.2 Massachusetts Public

The class from Massachusetts Public is a combined third and fourth grade class of twenty-two students. Once every six school days, they meet for a forty-five minute session in the school's computer lab. The computers are equipped with a variety of educational software, and the students are free to choose how they use their computer time. The students also have access to one computer in their regular classroom, which they use to connect to MOOSE Crossing during free moments.

They began using MOOSE Crossing gradually, beginning in April 1997. A few more students joined each week. During our visit in late May 1997, twelve of the eighteen students present chose to devote the majority of their time to MOOSE Crossing. This is typical of their recent sessions. The students stay primarily at their own desks during the sessions, but there is some movement around the room.

The students in this class have had moderate success with MOOSE Crossing to date. Most children have built a home, and a few have made pets. Given that they are younger than either of the other two schools and have been using MOOSE Crossing for significantly less time, their progress is notable. One student, Sara, has accomplished a tremendous amount. She has created more than 45 objects, and written a number of sophisticated programs. In fact, it was Sara's father, Mr. Penn, who brought MOOSE Crossing to Massachusetts Public after seeing the success his daughter had using MOOSE Crossing at home. Mr. Penn is a part-time graduate student studying education. He visits his daughter's computer class at Massachusetts Public approximately once per month. When he's not in the computer classroom in person, he logs on to help the children online. Mr. Penn is the primary support for the children's learning experiences with MOOSE Crossing.

Sara has been instrumental in getting her classmates to join MOOSE Crossing. Because of her extensive previous experience, Sara has become a local expert. Her peers ask her for help, and proudly show her their new creations at the end of the session.

2.3 Minnesota Public, Advanced Work

The advanced work students at Minnesota Public are pulled out of their regular classes to use MOOSE Crossing for an hour and a half once a week. The computer lab at Minnesota Public does not yet have Internet access. The fourteen fifth and sixth grade students are brought over to a university computer lab across the street by their advanced work teacher and a faculty sponsor from the university, Mr. Plum. Mr. Plum is the primary support for the children with their MOOSE projects. On the way into the university building, the students are sternly warned to be quiet and not disturb the college students. This contributes to giving their MOOSE Crossing sessions a somewhat formal atmosphere.

This class started using MOOSE Crossing in December 1996. For the first several weeks, they participated every other week. In March 1997, they began participating weekly. We visited the class in April 1997. The students in this class have had moderate success with MOOSE Crossing. At the time of our visit, most kids had built and described at least one room, and many had pets and other objects. The kids are working on projects of their own choosing. About half have written a few simple programs. Compared to the other two classes, the students seemed less enthusiastic about MOOSE Crossing.

During the session we observed, the students primarily stayed in their seats. They helped one another to a limited degree. Only towards the end of the session did they begin to get up from their seats to confer with peers more. Mr. Plum confirmed that this was the usual pattern of behavior, and said he felt that the kids were getting restless towards the end of the session. Our experience puts a different interpretation on movement around the classroom. When children are moving around, they are usually collaborating more effectively. However, this was not encouraged in this classroom.

3. Success Factors

Many factors contributed to the varied success of MOOSE Crossing in each of these settings. We will highlight issues of access, peer experts, free-form versus structured activity, and atmosphere.

3.1 Access

At California Public, computers are always readily available. Computers are located in the classroom, and there is a high computer-to-student ratio. During breaks in the day and after school, Mrs. Jay often sits at her desk grading papers, or taking care of other administrative tasks. When the children ask if they can use the computers during that time, it's easy for her to say yes. If they had to ask her if she would go with them to the computer room, she is unlikely to be able to say yes. Like most teachers, she is extremely busy. It's easy for Mrs. Jay to allow the students to use the machines, and it's easy for the students to think to do so—the computers are right there, all the time. The children regularly use MOOSE Crossing during their free time. At the simplest level, the students benefit from the increased time on task. Additionally, free-time access allows the students to *choose* to use MOOSE Crossing, adding a self-motivated element to their participation.

Most importantly, regular access allows children at California Public use the computer as a *tool*. Children use them to accomplish tasks even when not explicitly told to do so. In the other schools we visited, computers are more of a special event. While having one computer in the classroom does benefit the students at Massachusetts Public, it does not allow the computer to become a regularly-used tool. As Seymour Papert has noted, pencils wouldn't have had much of an impact on education if you had to go to the pencil room to use them. The presence of computers in the classroom facilitates not just a quantitative increase in the amount of time they are used, but also an epistemological shift in how students understand what computers are and what you can do with them.

3.2 Existence of Peer Experts

Central to the success of MOOSE Crossing at California Public and Massachusetts Public is the emergence of peer experts in the classroom. The peer experts answer questions, provide supportive feedback, and help sustain continued interest in the activity. Authentic enthusiasm from peers has a positive impact on the class' atmosphere and progress. At both California Public and Massachusetts Public, the children who have become resident experts have devoted significant free time to MOOSE Crossing. At Minnesota Public, none of the children have any free time access from either home or school, and no local experts have developed.

During their free time use, all of the student experts have gotten to know key members of the MOOSE Crossing community, including administrators and older children with significant technical expertise. They bridge the gap between their classmates and the larger community, helping to bring new ideas and expertise into the classroom. Their networks of supportive contacts in the broader community are particularly valuable.

At California Public, all of the children have free-time access, but only approximately half of them take advantage of it. At Massachusetts Public, only one student has free-time access from home, and one at a time from school. In both cases, however, the students who do use MOOSE Crossing during their free time have developed expertise and enthusiasm which has benefited the whole class.

3.3 Free-Form Versus Structured Activity

At California Public, the joint class project helped to structure the class' activity, facilitate collaboration among students, and sustain the group's interest over time. The students have developed a positive interdependence, learning in a collaborative fashion (Johnson and Johnson 1994). The group project scaffolded the learning experience (Guzdial 1994). The children had time to work on self-selected projects, in addition to working on their part of the class project. The teacher has established an effective compromise between free-form and structured activity.

At Massachusetts Public, the children's freedom to engage in any computer activity made their participation in MOOSE Crossing authentically motivated. Enthusiasm for choosing MOOSE over other computer activities grew over the course of the year. Their freedom to chose or reject this activity made their involvement with it more rewarding.

Children at Minnesota Public had neither the advantage of added structure or of real freedom. Some of the students seemed bored, and had neither the option to try another activity nor a shared project to guide them. This may be a contributing factor behind why they seemed less enthusiastic about the activity than the other classes.

3.4 Atmosphere

Towards the end of the first MOOSE Crossing session at California Public, Mrs. Jay exclaimed to the class, “This is chaos!” One of the students replied, “but it’s magical chaos.” Mrs. Jay and the other students concurred. In a looser sense, “magical chaos” might describe the atmosphere at California Public in general. We noted in particular that the school’s culture allows the children more physical movement than the children are allowed at other schools we visited. Children there are rarely asked to form lines. During computer class, the children frequently get up to ask other students questions or offer assistance. The cultural permission to move around enhances collaboration.

In contrast, movement is discouraged at the other schools we visited. When the faculty sponsor at Minnesota Public observes the students getting up to talk to one another more towards the end of the session, he interpreted this as restlessness and lack of engagement with the activity. Similarly, when a student at Massachusetts Public stood for a few minutes watching over one of her classmate’s shoulders, she was admonished not to waste her computer time, and ushered over to an empty workstation. Teachers of these classes acknowledge the importance of collaborative learning, but the school atmosphere is strongly influenced by the tradition of individual seatwork.

4. Conclusion

CSCL environments can help to foster and support collaborative learning in schools. However, our observations indicate that a computer-supported cooperative learning tool can not on its own cause a fundamental cultural shift. Factors that affect the success of MOOSE Crossing in the classrooms we observed include the accessibility of computers, school atmosphere, and teacher attitudes towards collaborative learning. Results of this study are being used to develop a set of practical suggestions to be distributed to teachers interested in introducing MOOSE Crossing to their classes. As Kolodner and Guzdial have noted, “Although it’s not clear if CSCL prompts changes in school structure or if changes from traditional school structure are needed for CSCL to succeed, it is clear that the two must at least be developed hand in hand” (Kolodner and Guzdial 1996).

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Bibliography

Bruckman, Amy (1997). “MOOSE Crossing: Construction, Community, and Learning in a Networked Virtual World for Kids.” PhD Thesis, MIT. http://www.media.mit.edu/~asb/thesis/

Geertz, Clifford (1973). *The Interpretation of Cultures*. New York, Basic Books.

Guzdial, Mark (1994). “Software-Realized Scaffolding to Facilitate Programming for Science Learning.” Interactive Learning Environments 4(1): 1-44.

Johnson, Roger T. and David W. Johnson (1994). “An Overview of Cooperative Learning.” *Creativity and Collaborative Learning* Eds. Jacqueline Thousand, R. Villa and A. Nevin. Baltimore, Paul H Brookes Publishing.

Kolodner, Janet and Mark Guzdial (1996). “Effects With and Of CSCL: Tracking Learning in a New Paradigm.” *CSCL: Theory and Practice* Ed. Timothy Koschmann. Mahwah, NJ, Lawrence Erlbaum.

Koschmann, Timothy, Ed. (1996). *CSCL: Theory and Practice*. Mahwah, NJ, Lawrence Erlbaum.

Oday, Vicki, Daniel Bobrow, Kimberly Bobrow, Billie Hughes, Mark Shirley, and Jim Walters (1997). "Moving Practice: From Classrooms to MOO Rooms." *CSCW*, forthcoming.

Papert, Seymour (1991). “Situating Constructionism.” *Constructionism* Eds. Idit Harel and Seymour Papert. Norwood, NJ, Ablex Publishing.