My Make-Believe Castle

An Epic Adventure in Problem Solving

As most of us know, getting students interested in problem solving is half the battle in getting them to think critically. Fortunately, the authors of this article have found and tested a new software program that actively engages students in solving problems in math and science. Along with many other teachers around the United States, our contributors implemented My Make-Believe Castle in kindergarten through third-grade classes and shared their observations and experiences on a listserv.

By Donna Bearden and Kathleen Martin

In January 1997, we embarked on a grand adventure with teachers all over the country, a collaborative project that aimed to get students interested in problem solving. This group of pioneering elementary educators agreed to try a new software program—My Make-Believe Castle from Logo Computer Systems, Inc. (LCSI)—with their students and share their observations on a listserv.

This project began with a dozen or so teachers in the Dallas–Fort Worth, Texas, area and an Internet invitation to other teachers to join the curriculum project. Before school was out in May, postings to the listserv came from approximately 100 teachers and math educators from around the country. All of them have contributed to this article because they continued to relate new stories about how their students were solving problems. Sometimes we tried to summarize the teachers' comments, but in many cases their words were so powerful that we included them verbatim.

Using the Program

After a brief introduction from the teachers, the students explored the program on their own. Teachers then shared their observations about the children's experiences on the listserv. In this way the project was two-layered: It focused on (1) how children learn and (2) how professionals develop through their shared reflections about children's learning. But this article is not about professional development, so we will consider only what our students learned.

Students enjoyed using the program again and again. They returned to solve more problems and make up more of their own stories. As they used the program over several weeks,

What Is My Make-Believe Castle?

My Make-Believe Castle is an adventure program that provides an environment with many options. The castle includes several rooms, including an entryway, a bedroom, and a dungeon. Outside the castle are a forest and underground mazes. The cast of characters includes a dragon, witch, wizard, jester, knight, horse, and two children. These characters can be placed in various scenes and programmed to perform different actions. Icons allow program users (children, in this case) to make the characters fly, spin, dance, slip on banana peels, scurry over ladders, and so on. Icons also allow students to manipulate the characters' emotional reactions. Students can construct their own stories or solve any one of several preprogrammed problems. Although the program is marketed for ages 4 to 7, it is appropriate for children throughout the primary grades. And the manual describes the problems posed by the program as well as many extension activities.

they seemed to move in and out of three identifiable learning modes: *pointing and clicking, wondering and wandering,* and *persistent probing.* Within each mode, the children learned a lot vicariously by watching and imitating other students. Collaboration seemed invaluable at first, but as children became more familiar with the software and its controlling icons, many of them liked to think about and carry out their own ideas by themselves.

Pointing and Clicking

Children were captured initially by the characters and tools. As they randomly pointed and clicked on various icons, they became familiar with the options available to them. A great deal of excitement and sharing occurred as the children made discovery after discovery.

> *My early-bird student approached the computer with caution. He sat down and began moving the mouse, discovering on his own what the symbols mean and how he could move to different levels. He was so engrossed that he didn't notice how many of his classmates had gathered around him. He couldn't ignore them for long, though, because they were shouting at him: "Try this." "No, try that!" "What does this do?"*

Although a few teachers were anxious for their students to move more quickly, they remained true to the agreement to allow students to establish their own pace. Indeed, some children needed a great deal of practice.

> *I want them to discover the microphone so badly, but no one has tried it yet. Perhaps they are so focused on the different options that they have discovered and that others have shared with them that they are not seeing undiscovered icons.*

Many teachers were eager for the children to "get beyond" pointing and clicking, but the children's absorption in this process suggests that powerful learning was going on. The aspect of surprise was particularly evident during this phase. The children could not yet anticipate what was going to happen when they pointed and clicked. Indeed, some with less computer experience were discovering that their actions caused the antics they saw on screen. Only by observing the results of these actions were the children able to connect their own actions with the consequences. This process of learning what to control and how to control it is a matter of coming to understand the meaning of parameters. Playing with parameters leads to recognizing constraints within a situation; it is an important prerequisite to problem solving.

Wandering and Wondering

The children's natural inquisitiveness led them to wander through the castle and wonder aloud what would happen if they tried various combinations of actions and characters. Once they discovered they could make one character change size, for example, they tried changing the size of all of the characters. Sometimes a student would focus on an action, such as slipping on a banana peel; every charac-

ter would then be subject to the banana peel test. At other times characters themselves would become the focus of attention, and the children would run each character through every action icon. A single character would slip on a banana peel, climb a ladder, reverse direction, plunge into water, and so on.

Two third graders working with the Castle program for the first time focused only on size and were having a great time with that single variable. They put all the characters in a scene and then kept changing their sizes so that some were very large and others very small. They seemed to find the juxtaposition of sizes quite funny.

When the children discovered a new tool or action, they tended to concentrate on that tool until they learned all of its capabilities. The children's actions appeared to be repetitive, but they were actually fine-tuning their skills with each new tool. Eventually they began to combine new tools with old ones, which led to increasingly complex interactions.

The point-and-click mode gave students information about the parameters of the Castle program—what they could and could not do. Wandering and wondering allowed them to explore the world of conditionals and its enticing "if … then" situations. For example, "If a ladder is placed across the stream, then the jester can cross over it instead of falling in." As the children discovered the causal relationships characteristic of "if … then" situations, they were able to master the conditions needed to make decisions and could thus determine what they wanted to do within each one. Now the children were prepared to plan. The difference between the children who needed to continue exploring and those who were ready for strategic planning was evident.

One student had not had as much experience as two veterans who were coaching him. He was very caught up in changing the form of the characters with the magic wand as well as the actions they were performing with the ballet slipper and the top. He really liked seeing the dragon whirl. The coaches, a boy and a girl, got quite bored with what he was doing and directed him to go to the woods or to the dungeon.

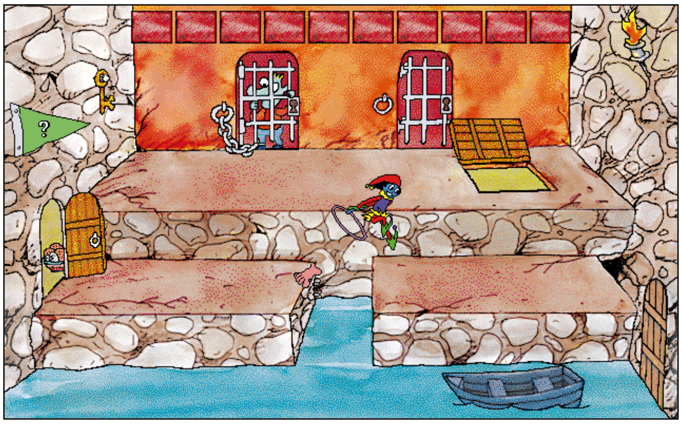
Although the boy at the controls followed many of the coaches' suggestions, he preferred to lead his own explorations. He was captured by the simple variations and would probably have continued for hours if he had not been interrupted. Meanwhile, the veterans were ready for something more challenging.

Persistent Probing

The first problem the children encounter is in the entry hall of the castle. It's the old dunking booth challenge. The scene includes a catapult, a bowl of fruit, a chair high up on the wall, a target, and a barrel of water. By putting the witch in the chair, placing a watermelon in the catapult, and then having a character jump on the other end, the child can make the watermelon fly through the air and hit the target, causing the witch to plunge into the water and scowl quite angrily. The catapult problem is not easy to solve. The variables include the weight of the item chosen to put in the catapult, the weight of the character chosen to jump on the other end, the path the character takes toward the catapult, and the location of the jumping icon. The children tried various combinations, engaging in a kind of successive approximation as positions were adjusted and readjusted. The program provided the immediate feedback, which enabled children to respond with modifications.

Although the software includes several problems, many children preferred to pose their own. Something would spark their interest, and they would begin to wonder what would happen if they tried this or that.

One kid was in the dungeon with the jester who kept falling in the water. The kid put the foot at the edge of the concrete walkway so the jester could jump across the water. The jester made it and then bumped into the wall at the other end. When a character hits a wall, it turns back in the other direction. This time the jester fell into the water coming from the opposite direction. So the kid put a foot on that side of the walkway. The jester jumped the space over the water but then landed on the first foot and



got kicked into the water. The kid never solved the problem of keeping the jester out of the water, but left determined to work on it more.

Variations on Persistent Probing

Two cases in particular demonstrate how differently children might approach the same tasks and challenges.

> *Today Jennifer went to her favorite place, the maze with the log and swimming hole. She chose the witch to go through the obstacle course. She placed the sneakers on either side of the log. As the witch hit the first sneaker, she cut (with the scissors icon) the sneaker on the other side to see what would happen. This caused the witch to fly around the rest of the course. Jennifer called me over to watch and about eight Castle Kids followed me. After she showed me what she had tried, everyone wanted to see if the dragon would fly with one sneaker. They then tried the wizard, the knight, the horse, and the jester. "Try this" and "I have a good idea" were echoed during this time … The students wanted to set up their own problems on the course rather than follow the program suggestions.*

> *Juan Carlos, a first grader, was at the computer. I was really surprised that he didn't ask me what certain icons did like he usually did. In fact, he was real quiet and was thinking of how to solve a problem. I asked him what he was up to, and he said that he was just trying something new to hit the bull's eye. Normally, he had relied on other's directives to guide his choices. After some time, he excitedly called out. When I turned around, I saw this big smile on his face. He was so proud that he had devised his own way of hitting the bull's eye. He wanted to tell everyone about it. So, of course, everyone dropped what they were doing and went over to listen and watch.*

The difference between Jennifer's and Juan Carlos's problem-solving approaches is revealing. For Jennifer, the problem is dynamic: It shifts and transforms in response to her own actions. Her initial problem was getting the witch to negotiate the obstacle course. Once she discovered the sneaker's power, her problem became one of checking the sneaker's impact on all of the characters. The preset problem of the obstacle course did not engage Jennifer as much as her own questions about what she could do with the sneaker.

Until they really understood the different dimensions of the castle environment, the children tended to pursue problems that involved the capabilities of the characters, tools, and action icons. Only when they had the parameters firmly in mind did they show persistence in following a plan like Juan Carlos. He spent considerable time working with the catapult and watching his friends do the same. Because he knew the complexity involved and was familiar with the different variables, he was able to imagine and then persist in discovering a new way to hit the target.

Working Together and Working Alone

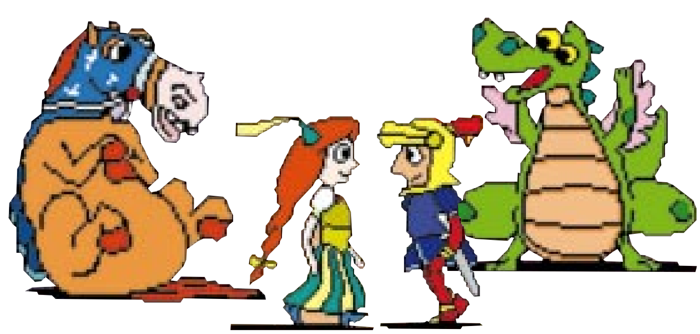
The collaboration and sharing of information seen in the earlier explorations became even more evident during problem solving. Children became teachers and offered their insights to their classmates.

> *Ryan asked Taylor how he got to a particular game. The sharing of ideas and the explaining to one another the how-to's, the pointing to the screen, the search for the words to explain to each other—it's amazing to watch and listen!*

The children genuinely and gladly acknowledged someone else's expertise when he or she discovered something new. They were eager to learn and thus afforded each other many chances to teach. No one child acted as the leader; leadership instead cycled from one child to another and was a function of what each child had learned. Leadership was thus acknowledged in terms of having learned something new.

> *Tyler began the day with, "You can learn a lot from us. We can be a teacher, too." The kids had found something I didn't even know existed. They were enthusiastic to tell how they had made the discovery and how to do it when I got my turn.*

Once the children began solving the problems built into the program and devising their own, an interesting phenomenon occurred. Children who had previously shared their computer time and did not seem to mind having four or five



coaching spectators began to express an interest in spending time alone. A teacher who had one student working alone with the headset was the first to observe this desire.

I just knew that Patrick would say that he hadn't enjoyed the Castle program as much without the crowd. Just the opposite. He loved it because he got to plan and take his time.

Other children expressed similar feelings. They liked time alone to plan.

I've been giving a lot of thought to how Patrick and several of the other Castle Kids are enjoying their own private, quiet time on the Castle program and how they are able to plan what they want to do and then pause and reflect on the consequences of their actions. They have time to decide what they want to do next, not what someone else wants them to do next. I will continue to give them their private space and personal time. Sometimes I think we get so into cooperative learning that we forget the need for individual planning time.

Extending the Castle Environment

At one point in the program, students must solve a maze. Most of them enjoyed this task so much that they began constructing their own mazes.

Believe it or not, two of my students (Ryan and Brett) made a maze using wooden cubes at the tables. They said it was like the maze in the anthill in the Castle program!

After a few days of watching the maze construction develop, someone decided to draw their own maze on paper. This led us off on a tangent for the rest of the afternoon. The children drew mazes and shared them with their friends to see if they could do them. I tried to draw one and it was hard. I'll be anxious to see what Kenneth comes back to school with. He is always inventing things, and he couldn't stand it that he did not get his finished, so he took it home to figure something out. By the way, his science fair project was a hamster maze that won third place.

Perhaps the best indicator of the Castle program's power can be seen in children's activities and insights as they go beyond the constraints of the computer and flow into other dimensions of the classroom. The measure of a good learning environment is its power to help children see connections and develop ways of thinking that are sensitive to complexity. With many computer programs, children engage until there is nothing new to discover or they have the game figured out. The Castle program offers children an opportunity to pose some of their own problems and then solve them rather than solve only preset problems.

Learning environments such as that created by My Make-Believe Castle encourage probing and experimenting. Children develop a powerful intuition about math and science even before such intuition can be articulated or reflected upon. Solutions to problems can be achieved only through persistence. Through these challenges, children have opportunities to estimate measurement, note relationships between variables such as size and speed, and test the effects of variables on one another. Also, the interactions seem genuinely collaborative in the way that children share perspectives.

It was exciting watching them problem solve together. They would disagree but in a respectful way. They would predict what would happen next if they chose a certain task or sequence of actions. They laughed out loud when the consequences of their actions were a total surprise. I was amazed at one of my students who has difficulty with self-control and can become very physical. When it was not his turn, he showed respect for whoever was in charge of the mouse by quietly offering suggestions.

Since the kids are constantly making new discoveries and creating their own sets of problems, no one has an I-know-it-all-attitude. They seem to know that they are working on a never-ending story. The continued support they give each other in this environment continuously energizes me.

Summary

The collaboration, the group and individual problem solving, the sharing of information, and the immediate feedback were all identified by teachers as important factors in both the software and the project. Although important, these factors may be the consequence of something even more significant. My Make-Believe Castle may be as important a learning environment for teachers as it is for children because it enables teachers to observe how children learn and then change their own teaching accordingly. ■

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Resource

My Make-Believe Castle is available on Macintosh or Windows CD-ROM for $39.95 (home) or $49.95 (school; comes with additional classroom materials) from Logo Computer Systems, Inc., PO Box 162, Highgate, VT 05460.

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