THE Cricket SMART HOUSE

MAS 714: Technologies for Creative Learning
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Table of Contents

"I feel like a scientist! This is fun!" exclaimed Becca[1], a 10 year old girl in the South Boston Boys and Girls Computer Clubhouse, as she held up her creation for her mentor to see. Becca and a group of her friends were working on a multi-week project with mentors from Harvard and MIT to build a Smart House. They used household objects to construct components of a house such as a stove, toilet or baby cradle. Then, they used laptop computers with PicoBlocks software to drag together blocks, creating programs of instruction which would be beamed to programmable bricks embedded in their objects. Within minutes, the girls could hear their toilets flush or watch a mobile rotate above a baby's cradle. These were entirely new experiences for Becca and her friends, and with the support of a group of girls at their after school program, they eagerly accepted the challenge.

The Problem

Women have been historically under-represented in engineering and other technological fields. According to *Women & Girls' Tech Up*, (2000),"In computer programming, the percentage of women is approximately 35 percent in the workplace, and 18 percent in post-secondary institutions. In middle school and high school computer classes, girls tend to be the minority." While it may seem like there are a lot of programs in existence to change this statistic and attract more women to these fields of study, the numbers have actually decreased.

In the August 16th, 2004, *U.S. News and World Report* the number of women graduating with computer science degrees in the last two decades was reported as dropping from 37

[1] Names have been changed.

to 28 percent. A "sense of isolation and inadequacy" (p. 4) is one of the contributing factors to this problem. Another surprising report is that females who drop-out of these college programs often have higher GPAs than their male peers. Computer science is not the only field that indicates a problem.

Nine-percent of engineers in America are women, and 20 percent of engineering degrees are earned by women according to the *National Academy of Engineering* project, Celebration of Women in Engineering (CWE), (2001). The project believes that this leads to many problems including a lack of diversity of ideas, and the addressing of issues which concern only half of the population. It also speaks to a larger staffing shortage in the engineering field if current trends persist. If women continue to be eliminated from this field the "United States will not have the trained personnel necessary to meet its needs." (CWE, 2001, Careers in Engineering Section, para. 1) Trends occur as early as elementary school to indicate a perpetuation of this pattern.

When the U.S. Department of Education, National Center for Education Statistics (NCES) released The Nation's Report Card in math and science some of the results were disturbing. The national test is given in fourth, eighth, and twelfth grades. Across all grades girls scored lower than boys in both the math and science portion of the test. While the gap is more noticeable in mathematics, there is no denying that male students performed better overall. This problem, which persists across all educational levels, must lead to speculation (NCES, 2004).

In *Life on the Screen,* Turkle (1995) equates the problem to the approach taken when teaching computer programming. She describes two styles or approaches to learning, hard and soft. The hard approach is typically "rule-driven and relies on top-down planning" (p. 51). Soft-style programming is "a flexible, nonhierarchical style that allows a close connection with one's object of study" (p. 56). While neither is exclusively male or female, more women tend to be drawn to the soft-style of programming. Unfortunately, since computer programming instruction is dominated by men, the soft-style approach to teaching is often neglected. Turkle and Papert (1990) further this argument in their article *Epistemological Pluralism and the Revaluation of the Concrete*. They cite the degradation of this thinking style as being one of the reasons that "Women's access to science and engineering has historically been blocked by prejudice and discrimination" (p. 1). This is, however, not the only theory.

Girls have a tendency, unlike boys, to be drawn to fields where they "can make a difference in society" (Heinemann, 2004). High-tech fields are not seen as the ideal path to reach these goals. Most science and math fields do not address realistic daily problems in peoples' lives until students reach advanced courses. Resnick, Berg and Eisenberg (2000) address a similar topic in *Beyond Black Boxes: Bringing Transparency and Aesthetics Back to Scientific Investigations.* In this article they discuss creating new objects for students that "allow children to create, customize, and personalize their own scientific instruments" (p. 2). While this undoubtedly appeals to students at-large, we see a particular appeal and opportunity to engage girls with this type of thought.

We will use the programmable bricks discussed by Resnick and colleagues for the Cricket Smart House activity. Through this project we hope to provide girls access to computer-programming in a realistic and enjoyable context, sparking interest and increasing self esteem. The goal of the activity is for the girls to design parts of a house that are used in daily activities of life. They will be likely to start out mimicking existing objects, and move to creating new, personally meaningful objects as they become increasingly comfortable with the technology and confident in their own abilities. All of this is to be done in an environment that allows and encourages multiple ways of thinking and solving a problem.

Existing Approaches

Several activities using Crickets or similar programmable robotics sets have been attempted in the past. Looking at those examples helped us to consider both what project aspects were important to include and what components might be lacking.

<u>Traditional Robotics Competitions</u>

MIT's 6.270 contest, *BattleBots*, and most middle school and high school robotics activities pit robots against each other in competition where the best robot wins. While these contests are growing in popularity as an exciting, hands-on way to introduce students to engineering and programming concepts, the participants continue to be overwhelmingly male. The mystery and intimidation that often accompanies technological objects can be largely dispelled when students become designers and builders of technology (Resnick *et al*, 2000). Traditional robotics competitions successfully engage male students in a challenging, iterative design process, but fall short when it comes to capturing the interest and participation of girls.

Wellesley's Robotic Design Studio

In an attempt to address the technology gender gap, Wellesley created a robot-based engineering experience that culminated in students sharing their robot designs in an exhibition rather than a competition. They hoped to appeal to students with a wide range of backgrounds by giving them the freedom to create any robot that interested them, and encouraged the use of art and craft materials for decorating the robots as a means for students to express themselves creatively (Turbak and Berg, 2002). However, while Wellesley's alternative to robotics competitions is more inclusive and gives an entry to building personally meaningful artifacts, we still felt that the term "robot" was open to potentially narrower interpretation for creation using Crickets than what we could envision, and could still serve as an intimidation factor to deter girls from interest in participation.

Robotic Creatures

Many Crickets or Programmable Brick projects involve constructing and programming robotic creatures. One elementary school created a Robotic Park full of creatures behaving based on what the students knew about different animals and their habitats. A group of fifth-grade students created a dinosaur that was attracted to the lights of a Jeep. A 12-year-old boy created a creature that taught a second creature how to dance (Resnick, 1998). We liked the idea that students could connect to a familiar concept (animal behavior) through the activity, but again felt that there were broader opportunities for Cricket use.

Bird Feeder, Gerbil Cage, Diary-Security System

Several Beyond Black Boxes projects use Crickets outside of the “robot” construct. One 11-year-old girl made a bird feeder that took pictures of the birds that visited. Several girls modified a gerbil cage to track their gerbils’ activities. A pair of girls built a system that took pictures of anyone who tried to tamper with their diaries (Resnick *et al*, 2000). These projects used Crickets outside of traditional robotics models and were personally significant for the girls. However, the time required for the girls to identify a project of interest and iterate the design to functionality was extensive – often three weeks of working full days on the projects. In the context of encouraging girls at the Computer ClubHouse to get excited about technology and comfortable with the idea of further exploration, we hoped to create an activity that could provide some gratification and sense of accomplishment within the first few sessions.

Marble Machines

In a workshop at the Science Museum of Minnesota, kids created contraptions in which marbles rolled down and bounced off objects, similar to the children’s game MouseTrap. One fifth-grade girl created a conveyor-belt Cricket for her marble (Resnick *et al*, 2000). While this project immediately captured the interest of one girl, we were concerned that it was similar to traditional robotics competitions in its higher appeal for boys, and were hoping for an activity that would specifically focus on the girl participant.

BitBalls

In an attempt to add computation to other childhood toys, a Cricket was embedded inside a transparent, rubbery ball. This BitBall had an accelerometer so it could know something about its motion and a set of LEDs so it could display some information about it (Resnick, 1998). The Cricket in a completely non-“robot” form was a very compelling idea, but as in some of the above-mentioned cases, we hoped for a Cricket activity that could cater specifically to girls’ interests in ways missed by previous projects. Games with balls are often traditionally more preferred by boys.

Digital Beads

On the other hand, beads have become popular among young girls in recent years. Digital Beads containing a built-in microprocessor and LED were created so that by inductive coupling they could communicate with neighboring beads. Kids could play with the beads by changing the interactions based on how they strung together pre-programmed beads, or write new programs for the beads (Resnick, 1998). These beads were inspiring in their attempt to provide accessible exploration of technology in a form already attractive to many young girls. The bead form, however, although containing some programmability seemed to limit the potential for creative design that the Crickets have to offer. Users would be locked into programming linkable lights that readily assume the forms of bracelets and necklaces, but do not offer immediately apparent options for other designs.

Chocolate Walk

An activity which aligned very well with students' already existing intuitions was the Chocolate Walk. Girls were given a Cricket with a temperature sensor and then taken on a walk to a local donut shop. The girls could attach the sensors to their clothing or touch it to things along the way (Resnick *et al*, 2000). While this activity provided the girls an opportunity for rich investigation and exploration in a familiar environment, we hoped to design a project that would also encourage creation.

Artistic Displays

An undergraduate student created artistic measurement devices with Crickets, such as a flower that opened in the light, and a device for displaying current paths in closed circuits (Resnick *et al*, 2000). We appreciated that this project focused on both functionality and aesthetics. But the concepts she was working with were somewhat abstract, and we hoped for something more concrete that girls could identify with.

Girls Currently in the ClubHouse

We visited the South Boston Computer ClubHouse and observed that the girls were almost universally occupied with certain kinds of activities – using software to put together various clothing options into different outfits, and making videos that provided a vehicle for playing "dress-up". It was clear that the girls' interests differed dramatically from the boys'. We did not want to invalidate their interests or force them into traditional activities that held little meaning or excitement for them, but at the same time, we hoped that they would want to get involved in projects that contained more substantial amounts of technology content. They were not moving beyond simple drag-and-drop type applications in their activities. We believed there was potential for them to be involved in building technology through creating and programming, so that they would be provided a deeper opportunity to access technology and increase their comfort with it.

Smart House Workshop

The Science Museum of Minnesota held a five day Smart House Workshop. They met for 3 hours each day, working with craft materials and Crickets to build their high-tech dream homes of the future. They began with an introduction in which they talked about interesting houses with “smart” features, and then constructed a fantasy chair out of craft materials. This was followed by a 15-minute Cricket mini-project where they were asked to turn on a motor with a sensor. Then, they spent a large amount of time constructing the structure of their houses without adding any technology. Because very few of the kids had any experience with Crickets or RCX and their introduction was pretty brief, kids spent very little time programming and a lot more time trying to get certain mechanisms (such as a door that opened and shut properly) to work (Pezalla-Granlund, 2004). We appreciated the idea of working on a dream house as a context familiar and interesting to many girls. The activity also offered rich opportunities for creativity and programming. However, the Science Museum provided little tinkering time for the kids to explore Cricket capabilities, which resulted in projects focused mostly on craft material constructions, rather than “smart” houses. We believed that presenting the idea differently could result in a higher degree of programming and building with technology while still exciting interest and enjoyment in girls.

Design Principles/Rationale

The design of our Cricket Smart House activity is driven by our desire to expose girls to an accessible, innovative technology which is a tool for personally relevant design which can transform ideas into concrete items. A goal sited by the Cricket creators themselves, "to contribute to the development of a new generation of students who are more likely to "look inside" the technological artifacts in the world around them—and feel empowered to develop their own tools (even very simple tools) for exploring phenomena in their everyday lives (Resnick et al, 2000, p. 17)" can also be applied to this Cricket application activity. Girls, who typically shy away from traditional ideas of programming and activities which surround it, will be given the chance to work together to build their confidence in this typically male field while at the same time creating a tangible finished product which could be used in daily play and can be shared with other Computer Clubhouse members. Our activity will encourage girls to apply programming knowledge which can be gained from experimentation with Pico Blocks to the design of a house which is constructed and decorated in a personally meaningful manner. Our hope is that by combining a new technology with an activity which we know to be already of interest to the girls, they will develop intrinsic motivation to experiment and in turn gain a broader understanding of the principles behind the Crickets. At the same time, we hope that the girls apply their creativity to gain an increased understanding of common items found in a home.

Evolution of Design Process

This Cricket Smart House activity evolved as a result of our study of gender inequity in Mitchel Resnick's "Technologies for Creative Learning" course, our observations at the South Boston Computer Clubhouse, and our own experiences with Cricket technology. As girls ourselves, we can vividly remember struggles in male dominated programming courses during our high school and undergraduate years: frustrations with explanations of the concepts behind programming, confusion about thought processes modeled for us and difficulty of the assignments expected of us. Our first introduction to programming Crickets in the MIT Media Lab was quite the opposite experience. We found ourselves excited to experiment and thrilled when our simple constructions on the screen translated almost immediately into the Cricket behavior we envisioned.

Although the South Boston Computer Clubhouse is promoting a technological fluency in theory, what we saw during our preliminary observations was very different and a bit disturbing. A group of girls between the ages of 8 and 11 met every day in a room full of well equipped computers but clearly were not aware of the potential they held. A well meaning activity intended to film a movie with Intel digital video cameras which could then be edited on the computer comprised the majority of the girls' time in the clubhouse, and had degenerated into a daily opportunity to dress up in different costumes and dance around the building. Videos were rarely downloaded to the computers and often never even viewed after taping. Of the girls who did work on the computers, the most common activity we saw involved the use of a software program which could be used to create outfits for dolls by sliding different pieces of clothing together. These girls were not short on creativity; we hoped to harness this characteristic and guide them to apply it through design of a Cricket Smart House.

Design Constraints

The design of the Cricket Smart House which will be created by the girls from the Computer Clubhouse is limited by art materials available at the Boys and Girls Club or in our own households and also by the various components of the Cricket technology kits. In addition to the Crickets and USB connectors, we will make the following available to the girls during design:

- Light bulbs
- Light sensors
- Small red motors
- Large opaque motors
- Resistance sensors
- Numeric displays
- Touch sensors
- Sound speakers
- All necessary connection wires
- One laptop with Pico Blocks for every group of 2-3 girls
- Craft materials

Key Activity Features

The creation of a Cricket Smart House is designed to be used by a group of girls at a Computer Clubhouse and will progress through the following phases:

1. *Introduction and Demo:* Girls will be introduced to how Crickets work and be shown a short demonstration of sample designs by other children (example: wandering wand or secure diary). This gives the girls a starting point for their own creative ideas and a foundation for brainstorming about potential applications.

2. *Tinkering:* Girls will have time to explore with Crickets on their own, developing a level of comfort and initial understanding of the technology within the constraints of available components.
3. *Design materials:* Readily available household objects will be introduced into the girls' tinkering activities. Using such a "blend of high-tech devices and art supplies makes possible precise explorations and investigations while simultaneously fostering a spirit of creativity, exuberance, humor, stylishness, and personal expression" (Resnick et al, 2000, p. 6) thus incorporating several of our activity goals.
4. *Brainstorming:* We will guide the girls to think together about potential uses of Crickets in their smart house, and they will put together a list of creative ideas they would like to try which are of personal interest.
5. *Collaborative Design:* Girls will work together in small groups to build household components with Crickets embedded. When necessary, we will provide examples of how to build household objects such as an oven out of a tea bag box, a sink using a plastic bottle top and bendable straw, etc.
6. *Decoration:* Girls will be encouraged to decorate the house which will house their Cricket creations using available household materials between sessions with Crickets. As explained by Resnick and colleagues (2000) "aesthetics become increasingly important, if only because scientific instruments become part of more "lived-in" environments. Quite literally, the girls are creating a model of an environment which could be "lived in" and are thus given the ability to apply and

explore artistic talents to result in an attractive final product which reflects their own interests and preferences.

7. *Sharing*: Girls will be encouraged to obtain an I-Village account and work together to post pictures and narratives about the design process as well as their final product on the I-Village website. Because Crickets are not yet available for sale and cannot be left with the girls at the clubhouse, an I-Village summary will provide a lasting record of their work upon completion. In addition, the girls will be able to share their completed Cricket Smart House with clubhouse members and mentors from across the world.

A Possible Scenario

A group of adolescent girls and adult mentors meet at the clubhouse for Girls' Night on the same day and at the same time every week. This week a member of the clubhouse has decided to introduce a new technology called a *Cricket*. The member has been working with the Crickets a little and is going to give the group a demonstration of what she already knows.

All of the girls and mentors gather around the table in the center of the room and the demonstrator shows them a Cricket. She talks to them about all of the attachments that she has worked with, including the touch sensors, lights, light sensors, motors, and sound accessories. While she is doing this she shows the group the different parts that are laid out in front of them and some of the members pick them up and examine them. After they have all seen the parts the demonstrator says she would like to show them how she made a program to get the light to turn red when she pushes the touch sensor.

The demonstrator sits at a computer with the PicoBlocks software and cricket USB attachment and talks aloud through the process she went through to program the cricket in the software. If people have questions or comments she answers them if she can, or encourages the girls to experiment on their own to find the answers. Once the program is complete she demonstrates the process of hooking up the sensor and light, then she shows them how to program the Cricket. She then demonstrates how the program works to the group. The group reconvenes in the center of the room.

Before the presenter began, she made sure the software was installed on several of the computers and that all of the materials were available for the group. She tells the rest of the group this and allows them to choose the materials they would like to work with. Girls settle at the computers alone and in small groups. Some are working with lights and touch sensors like she had demonstrated, while others are working with light sensors, motors and sounds. Mentors are wandering around the room observing and working with small groups to brainstorm ideas or work through problems. Students continue to tinker like this for several days.

Once the group has worked with the PicoBlocks software and Crickets enough to feel comfortable one of the mentors suggests a group project. The mentor suggests they make a Cricket Smart House where objects are animated. She pulls out pictures of things in a dollhouse made from found objects, such as toilet paper rolls, bottles, soap boxes, scrap paper, and aluminum foil and suggests that they make some of these objects and think of ways that the Crickets can be used to make them come to life. Girls that are interested join the group and brainstorm how they are going to go about making the house. Each girl or pair of girls eventually picks a project she/they would like to work on, agreeing to combine their creations in the end as the many parts of a house.

Over the next couple of days they work together to build and animate many features of the house. One group has decided to make a toilet that will flush when the handle (touch sensor) is pushed. Another girl has decided to make an oven that will light up when it is turned on. Several other groups are working with motors and light sensors to animate other objects. At the end of the week the group gets together and talks over what they have done and what else they would like to do.

After a couple more days a mentor suggests that they present what they have done to the rest of the clubhouse. Each member of the Smart House team talks about what they have done and how they have programmed their Cricket. Some of the girls show their programs and then demonstrate their object. Afterwards the whole group talks about other ways that they might use the Crickets.

Some of the group continues to work with the Smart House, while others use the Crickets to create new objects. Eventually the use of Crickets becomes part of the Clubhouse Culture, and a tool they are comfortable using to think and play creatively.

Evaluation

<u>Tinkering Phase</u>

We began by showing the girls the crickets and a few projects which had been created by other children such as the "Wandering Wand." These examples spawned conversation about how they were made, and programming the crickets. Several girls mentioned that they "knew how to use computers" but didn't know how to use them "in the way" necessary to be able to program something. The girls themselves used the word "programming," and seemed excited at the possibility of learning this new skill in the safety of a group of girls in our "log cabin" at the Boys and Girls Club. We briefly explained the process of writing instructions to tell our crickets what to do on our computers, and transferring them to the cricket by placing the cricket and the computer cord near each other. The girls picked up quickly on the concept of keeping the crickets "eye to eye" to enable transfer and were eager to get started. We introduced the idea of incorporating these crickets into a house which we would build together, and this took the discussion away from technology for a bit. The girls were very excited about the opportunity to decorate the boxes which would make up their house, and wanted to discuss at length who would make which room of the house, what colors they would use, and how big their boxes should be. They began searching nearby rooms for available boxes for their projects, and we finally brought them back on task by suggesting that they decorate the boxes during the weeks, and focusing on the crickets when we were with them, since we could not leave the crickets or our computers with them.

Figure 1.

We introduced some basics with the crickets (see Figure 1.), starting with making them chirp or light up, and gradually adding if statements, touch sensors and motors. During this phase of the activity, the only direction from the mentors involved dragging the chirp button to the screen—the girls took it from there and quickly discovered many of the cricket capabilities on their own. Some girls caught on very quickly and constantly wanted to know more, trying things without hesitation and demonstrating excitement at the outcome of their programs. Others talked at length about decorations for the house and had some great ideas for how to use crickets (such as building a blender) but were hesitant to get their hands on the computer. It seemed that some were too excited and distracted to sit still long enough to focus and develop an understanding, while others were too shy to gain time on the laptops over the more aggressive girls. When we suggested that the shy girls took a turn "driving," they repeatedly demonstrated a great understanding of the technology, one even created a basketball hoop and a ball out of a gum wrapper. She used a resistance sensor to sense when a ball came into the hoop and incremented a scoreboard accordingly. All of the girls seemed to love the fact that they could immediately see the results of their creations, and were very motivated by the simplicity of the instructions they had to give the crickets. We encouraged the girls to share their cricket creations with each other and it seemed that everyone was eager to continue exploring.

The tinkering phase lasted for a few weeks, and the girls remained largely focused on experimenting with the various cricket applications, rarely mentioning the house decoration. Over time, we observed that many of the girls began to fall into patterns in their tinkering, creating the same things repeatedly. A few of the girls loved making the light bulbs turn on and off, and only changed the colors for a long period of time. They were not interested in suggestions for other things which could be done with the lights or other cricket components. A few others focused on a motor, changing the pipe cleaner which they stuck inside but rarely looking back at their program. While we had seen the girls brainstorming many different cricket applications and their initial enthusiasm for exploration, it seemed as though they were falling into a comfort zone and possibly missing out on more meaningful, exploratory type of play. We did not want their initial ideas to be forgotten, and also wanted to be sure that they had opportunities to apply the understanding that they clearly had gained through their tinkering.

Smart House Component Construction

In an attempt to encourage the girls to explore the Cricket's capabilities beyond the comfort zones they had settled into, we provided examples of components that could be included in a house. The following website provided ideas for creating a dollhouse out of common household items:

http://familyfun.go.com/arts-and-crafts/buildmodel/feature/famf0200dollhouse/

From this website, we printed a variety of pictures of objects that might be found in a home, and included descriptions of how to create these elements. Each of the objects was on a separate sheet of paper. Below are some samples.

Stainless Steel Stove:
Set a tea box on end, then cut off and discard the top half. Cut a door opening with a window in the front panel and wedge plastic berry basket "racks" in the oven. Glue on pieces of cardboard for a stove top and control panel, then cover the entire stove with aluminum foil. Attach paper fastener "controls" glue on bottle cap "burners" and tape on a paper clip "door handle."

Frost-free Fridge:
Set a tea box on end. Cut door openings. Wedge a cardboard "shelf" inside the top half for the freezer box. Then stick layered paper hole reinforcements to the inner sides of the fridge and fit the ends of plastic straw lengths into the centers. Set racks cut from plastic berry boxes atop the straw frames. Attach paper clip door handles.

Toilet:
For the tank, paint a soap box white and cut a round hatch-style opening in the front to serve as a toilet seat cover. Screw a brass cup hook into the side and wrap a strip of tissue paper around it. For a toilet, cut the top from an individual-size plastic juice carton and invert it. Glue the tank and the toilet onto a base of thin cardboard cut to fit.

We provided the items that were suggested for building the household objects, as well as craft items such as construction paper, tape, glue, pipe cleaners, scissors, rulers, and markers. When the girls entered the room, the descriptions and building materials were spread out in the middle of the table. Although we did not assign them to build anything specifically, the girls immediately began looking through the pictures and asking if they could make the objects. Alone or in pairs, they took the descriptions and necessary craft materials and began building.

As two of the girls worked on constructing an oven, one remarked, “It would be cool if the inside was red so it looked like it was hot. Hey, we could use a red light from the Crickets.” The other girls overheard, and soon everyone had joined in talking excitedly about how they could use the Crickets to do things like make the toilet flush, have the computer play a song when it turned on, make a light for the refrigerator, and have a rotating mobile for a baby crib.

Five of the girls completed objects and programmed them using the Crickets in one 2-hour session. Two of those five worked together on an oven, and then moved on to complete a computer table with laptop. As they were programming the laptop with an on-button that triggered a song, one of the girls commented, “We’ve never done anything like this at the ClubHouse before.” One of the mentors asked what she thought of it, and she responded that she thought it was really cool. When asked if she would like to do more activities like it, she replied enthusiastically, “Yeah!!!”

Three of the girls created objects, but did not incorporate Crickets. Of those three girls, one had in mind from the start how she was going to use the Crickets in her oven, but ran out of time to implement it because she was very careful in making a well-constructed oven. She successfully programmed her oven the next session (Figure 2), showed it to her mom, and came back to tell us her mom had given her a hug and a kiss and told her she’d done a good job.

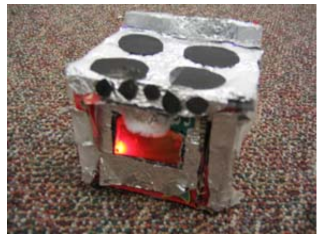

Figure 2.

The other two girls who did not use Crickets in the first session both successfully programmed objects in the second session. One completed a brand new object – a Christmas tree with lights that changed color. The other girl wanted to program the baby crib with mobile that she had created in the previous session. She made the mobile rotate successfully, but then immediately disassembled it, saying she did not like the way it looked. She then programmed a bed she had previously made to play a lullaby, but then immediately dismantled that as well, insisting that it did not look good and she did not want to show it to anyone or have any pictures taken.

We feel that providing additional materials and a small amount of direction helped the girls to challenge themselves in further exploring the capabilities of the Crickets. Because they had specific ideas about what the Crickets could help their objects do, they moved beyond the basic Cricket components that they had previously settled into using.

Exhibition

The last part of the Cricket Smart House project was to allow the girls to exhibit their creations on The Village. This is a site designed especially for members of the Computer Clubhouse to post and view projects, communicate with other members and try new software. Each girl in our group either had her own account on The Village or we created one for her.

Throughout the Smart House activity, we took pictures of the girls as they tinkered and also captured their final products to allow them to share their ideas with the rest of The Village community. When they were ready to post their projects we encouraged them to choose pictures to illustrate what they had done. Each girl also provided a description of the process she went through in designing, constructing, and programming her component. Due to time limitations, Village errors, and typing frustrations some of the girls dictated and we typed their ideas into the site.

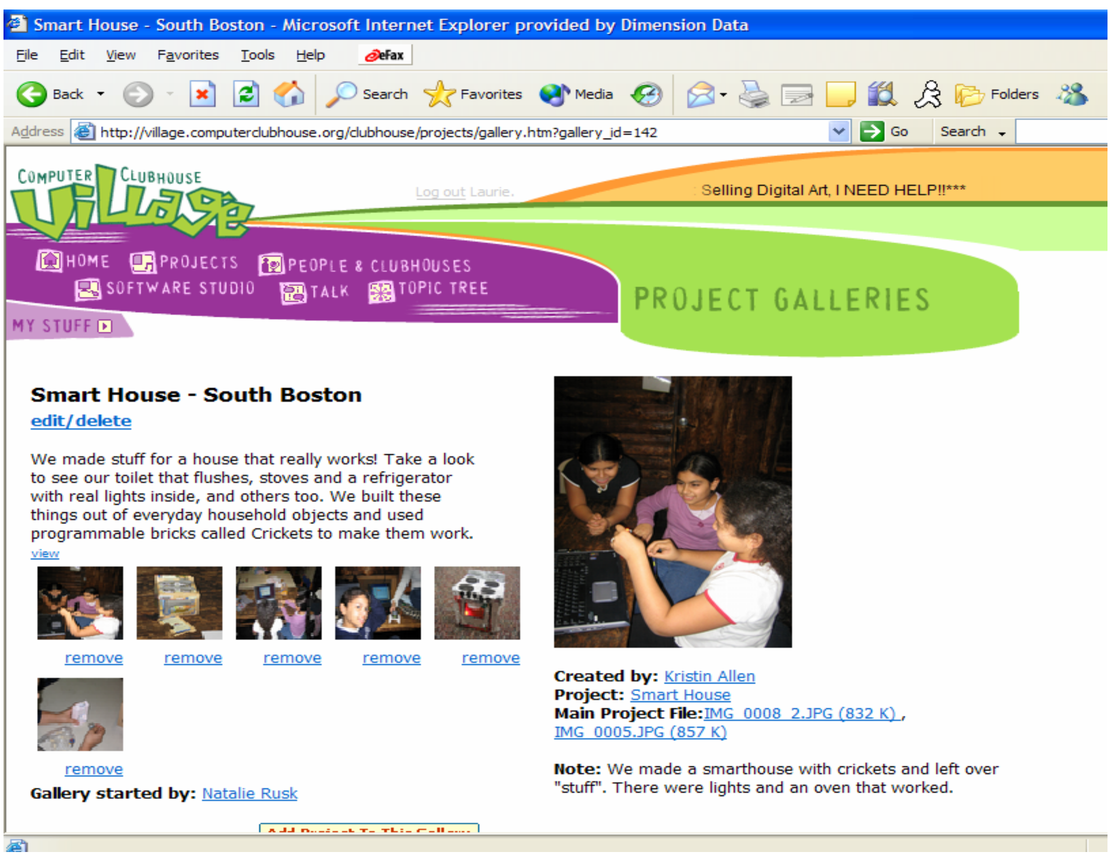

Figure 3.

As the girls completed their project postings we added them to a group gallery on The Village (see Figure 3). Our intentions in exposing the girls to The Village and having them post a project of their own was to encourage them to visit and explore it more often, since many of them expressed that they had not used it before. One girl mentioned that she would be checking her email to see if anyone asked her questions about her project. We hope that access to the collaborations and ideas on The Village will spark them to creatively explore a wider variety of new technologies in the Computer Clubhouse. In addition, many girls expressed interest in sharing their creations with their parents and friends. The Village provided them an easily accessible way in which to share what they had done.

Future Directions

In future implementations of the Cricket Smart House activity, we would recommend that students work over a longer period of time, with more frequent mentor interaction. Logistical issues such as mentor background checks should be handled prior to beginning this activity as to prevent distractions and breaks in the exploration.

Girls should be encouraged to work in pairs to stimulate collaborative problem solving with peers and allow the mentors to evenly distribute their time amongst groups. Adequate amounts of supplies are necessary to foster creative building and when possible, increased access to the technology for each girl would be helpful. In order to allow the girls to explore and create a variety of the ideas which they generate, more crickets and laptops with PicoBlocks would reduce wait time for access to these items. In addition, the creations could remain intact throughout the Smart House building project instead of, for example, having to remove a cricket from the stove to make the refrigerator work.

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