

# Exploring Girls' Values and Perspectives in Making for Others

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## Abstract

This study explores a pedagogical framework on how “making for others” can influence and engage girls in maker activities. We are particularly interested in how the relationship between builders and their clients can influence the builders’ making process and their motivation throughout that process. Feminist literature suggests that girls tend to locate themselves in relation to the world and describe themselves through actions that bring them into connection with others (Gilligan, 1982, p. 35). Leveraging the school’s Big Sister - Little sister mentorship program, the fourth-grade builders were asked to make toys for their first-grade clients. Throughout the year, builders worked closely with their clients to iterate on their toy designs, developing a close relationship and personalizing constructed toys to align with the clients’ requests. The interview data indicate that builders were constantly thinking about their clients’ needs and that they were proud of seeing their client’s satisfaction with the handmade toys. Additionally, we have found that encouragement and emotional support from peers and teachers are also vital for young female builders in completing their projects.

## Keywords

making; girls; constructionism; maker movement; diversity; elementary students

## Introduction

Peppler and Bender (2013) refer to the *maker movement* as “a growing culture of hands-on making, creating, designing, and innovating.” (p.22) Similarly, Halverson and Sheridan sees the maker movement as a group of people who are involved in “creative production of artifacts in their daily lives” (2014, p.496). As a movement, a group of “makers” often share their processes and products with others. Makers’ distinctive identity is their do-it-yourself (or do-it-with-others) mindset. They find making, tinkering, inventing, problem-solving, discovering and sharing intrinsically rewarding (Kalil, 2013). *Maker activities* provide learners with hands-on experience to design, experiment, build, and invent as they engage in activities that involve science, technology, engineering, math (STEM), and art. It draws people with interest in a range of activities, from textile craft, robotics, cooking, wood-crafts, electronics, digital fabrication, or mechanical repair (Peppler & Bender, 2013). Making in education is not new. Constructionist scholars and progressive educators have been advocating for learning through making since the 1960s. When learners make, they construct personalized connection to the artifact that engages their thinking, feeling, and learning (Wilensky, 1991). The construction can be anything from programming to painting, to carpentry, to making a hypothesis for a scientific experiment, or even to writing poetry (Papert, 1980). The term “maker movement” became more widely recognized in the early 2000s with the establishment of Make magazine and Maker Faire (Dougherty, 2016). Nevertheless, the making practices that were portrayed through these popular media outlets have demonstrated a very narrow representation of making featuring mainly male dominated practices like electronics, vehicles, and robots (Buecheley, 2013).

The maker movement has a high potential to reach people from diverse backgrounds through hands-on making. However, the movement has predominantly targeted wealthy and highly educated men (Buecheley, 2013; Maker Media, 2014). In an effort to expand the space of what counts as “making” in this maker movement, researchers and designers have worked to bridge traditionally feminine domains such as craft and fashion to computing and engineering. For example, the LilyPad Arduino allows learners to sew and program electronics. Many organizations have developed coding games for girls as well as organizing girl-only coding camps. These efforts have played an important role in increasing girls participations in maker activities; however, there is a danger in over-generalizing or simplifying women’s interests. Generalizing girls’ preferences and superficially including features like fashion and beauty into the learning environment can be problematic. The act may aggravate gender stereotypes and community divides (Holbert, 2016). An alternative way to create a more inclusive maker-centered learning environment may be to directly consider women’s values and goals and then evaluate how these values can be reflected in the design of maker activities and spaces.

This paper explores a pedagogical framework based on values cultivated by women to build connections with others (Belenky et al., 1986; Gilligan, 1982) that can engender more girls to participate in maker activities. It is a part of the wider two-year Bots for Tots design-based research project (Holbert, 2016) where we engage young learners from diverse communities to build toys for younger kids in their school rather than for themselves. Using data from the second iteration of the Bots for Tots program where all participants were girls, we investigate the relationship between fourth-grade builders (Big Sisters) and their first-grade clients (Little Sisters) and the relationship’s impact on the builders’ making process to explore a pedagogical framework on designing maker activities for girls. In this study. Our research aims to answer the following questions:

- How does making personalized toys for their clients motivate and help builders to persist through challenges in completing their toy design
- How do builders persist through times of discouragement encountered during their making process?

We present findings about how the relationship between builder participants and their clients motivated the builders during the making process.

## Literature Review

### Diversity in the maker movement: Engaging women in making

In the United States, the maker movement has struggled to expand its participations beyond affluent and well educated men. An attendee survey of the 2014 Bay Area Maker Faire showed that 70% were male, 97% attended or graduated college, and earned a median household income of \$130,000 (Maker Media, 2014). Moreover, 85% of the 41 people featured on Make magazine covers (2005-2013) were men. Likewise, a very narrow definition of maker activities had been portrayed on the covers featuring, 53% electronics, 31% vehicles, 22% robots, 8% rockets, and 5% music (Buechley, 2013). Revisiting these data three years later, Buechley (2016) called on the maker community to focus their efforts on inclusion, arguing that if the program is not inclusive, it is discriminatory. Instead of narrowly defining STEM and maker activities, Buechley argued for the inclusion of STEM-rich activities practiced by diverse communities and cultures (2016). For example, knitting should also be considered as a mathematically-rich activity as creating designs and patterns requires intricate calculation.

At the same time, we should not force learners to take on an externally imposed identity but should support them in building their own unique one. For instance, not all learners will be drawn to the “hacker” identity predominantly advertised by many maker communities (Worsley & Blikstein, 2016). Women in particular may find this framing uninviting (Fisher & Margolis, 2002). Martinez (2015) suggest educators to be sensitive of their classroom environment as women can react to surroundings that reflect stereotypical hacker culture by denying that they are interested in science and engineering.

Linking science and technology with learners’ values and area of interest can help create an inclusive STEM and maker-centered learning environment for women (Rosser, 1990). Findings from Margolis and Fisher’s (2003) longitudinal research show that context is very important for women. They suggest bridging other disciplines such as medicine, arts, and environmental science to computer science as well as connecting learners with local communities to sustain women’s interests in technology-focused fields.

Margolis and Fisher’s (2003) research also aligns with Belenky, Clinchy, Goldberg and Tarule’s (1986) seminal work on ways of knowing cultivated by women. They examine two distinctive forms of knowing: separate and connected knowing. Generally, the separate knowers tend to be more critical and detached from feelings and emotions. On the other hand, connected knowers are more empathetic. They try to understand others’ perspectives and share their own experience to foster relationship. They are driven by the desire to connect. Gilligan (1982) used the term “separate” and “connected” to describe two different conceptions or experiences of the self (separate from others) and in relationship (connected to others). Interviewing eleven-years-old boys and girls, Gilligan found that girls tend to locate themselves in relation to the world and described themselves through actions that bring them into connection with others (p.35). To examine separate and connected knowing, Belenky et al. (1986) conducted a survey that holds statements indicating “separate knowing” and “connected knowing” and found that their female participants had higher tendency toward connectedness. It is noted that separate and connected knowing are not gender specific and both ways of knowing have no correlation to intellectual capacity. Though not all women are connected knowers, this epistemological belief can help us design an inclusive and supportive maker-centered curriculum suitable for women without relying too much on activities or discourses related to gender stereotypes such as girls prefer pink toys or beauty related products (Holbert, 2016).

As Belenky et al. (1986) and Gilligan (1982) have suggested, women tend to value social interactions and a sense of community. They talk about their negative feelings (stress, anger, and disappointment) with others significantly more often than men (Simon & Nath, 2004). In a stressful situation, women are more likely to express their feelings and cope with their emotions

by seeking social support, as compared to men (Thoits, 1995). In maker activities, women work collaboratively, provide support, and help their peers more often than men (Intel Corporation, 2014). Women are more motivated by the social service aspects of making, particularly, they want to help or give. This act can be as simple as creating gifts for family and friends (Intel Corporation, 2014). Literature suggest women have higher tendency than men to favor collaborative relationships to competition and enjoy helping or giving back to their community (Mosatche et al., 2013). Leveraging these findings, maker-centered environment that support working together and working for others can leads to an increase in confidence and performance for women in making.

## Methodology

### Population and Site

The data presented here is from 41 fourth grade builders (aged 9 to 11) taking an Engineering and Design class at an all-girls private school in a suburban area in the North-Eastern United States. Leveraging school's Big Sister - Little Sister mentorship program, the Bots for Tots project had an explicit goal of having the fourth grade builders or "Big Sisters" to design and build toys for their first grade clients or "Little Sisters". The class began with two sessions of making with a 2D to 3D objects with cardboard in order to familiarize the builders with tools and materials in the lab as well as warming them up for creative activities ahead. After the cardboard sessions, the builders interviewed their clients using the "Client Profile" worksheet. They questioned their clients about the toy they liked and disliked. Then, the builders used the Client Profile worksheet to discuss with their classmates and brainstorm toy ideas within a small group. After two sessions of prototyping, the builders met their clients again to show prototypes they made and receive feedback for further iteration. The builders spent seven sessions to make their final designs. The instructor also allowed the builders to take the toy home for the last weekend if they could not complete the toy in the class time. The builders met their clients for "play date session" on the last day of the semester where the girls exchanged the toys and played together. All names used in the paper are pseudonyms chosen by the participants.

### Data Collection

#### Interview

Of the 41 builders participating in the study, 12 were randomly selected for one-on-one interviews. We interviewed the builders at the beginning of the year, before the Bots for Tots project had begun to determine builders' experience with technology, construction, and crafts as well as knowledge of relevant making and engineering concepts or skills. Interviews lasted approximately 30 to 40 minutes per builder. We interviewed the same builders again at the end of the year after the class had concluded. In the post interview, builders were asked about their experience of making toys for their clients. Our goal was to understand how making for their clients influenced the overall making process and how builders may have developed an interest in making. The interview was video recorded and transcribed. The data was coded "bottom-up" where themes and coding categories emerged from patterns in the data (Miles et al., 2014). For example, one code categorized instances where the participants changed their initial designs after receiving feedback from their clients and another identified instances where participants reference their clients while making their toys. A subset of the codes relevant to this analysis were applied by coders outside of the primary coding team. Interrater reliability was computed for each data set with all sets achieving greater than 0.7 Cohen's Kappa initially and improving to greater than 0.9 after discussion.

#### Field notes

Detailed field notes were taken during observations of the Bots for Tots project. These observations focused on fourth-grade girls' conversation with classmates and instructors about their clients' toy preferences and feedback. Particularly, we looked into the builders'

development of toy ideas, feedback from interview with clients, changes that builders had implemented after the feedback session.

### Artifacts

A variety of artifacts were produced by builders throughout the Bots for Tots project. These include in class worksheets, photographs of builders giving toys to their clients, as well as photographs of their toy designs throughout the construction process. Following are artifacts investigated:

- *My Client Profile worksheet*: Builders filled out the My Client Profile worksheet, indicating their client's toy likes and dislikes, during the first client interview. Here, we investigated the requests their clients originally made.
- *Brainstorming worksheet*: Using the data gathered from the client interview, builders discussed and brainstorm toy ideas with their classmates. Next, they finalized their toy idea and materials that they would use by drawing and filling in their toy design plans. We wanted to see how builders brought in clients' preferences in coming up with project ideas.
- *Client's feedback worksheet (Figure 2)*: Approximately half of the way into the project, builders presented their prototypes to their clients to receive feedback. This form guided that process by providing questions that included clients' preferences and concerns about the prototype and whether or not the prototypes met their expectation. We wanted to look into feedbacks from the clients and how that the feedback had led to the builders' changes in their designs.
- *Prototypes and Final Project*: Builders built prototypes of their toys as a quick and tangible way to express their ideas and receive feedback from their clients. The final project was the last iteration of the toy given to the clients on the play date session. We investigated the builders' prototypes and final projects to see the changes they had made in each stage of designing toys for their clients.

### Study Design

41 fourth grade builders from two classes (20-21 builders per class) participated in the study as a part of their Bots for Tots project, a bi-weekly class which ran 45 minutes per session. Throughout the academic year, builders participated in 19 sessions in total as described on Table1.

Name of activities	# of sessions the activity occurs	Major activities
Pre workshop interview with twelve builders	1	Interview 12 builders about their experience and familiarity with tools and toys related to maker activities
Make 2D to 3D cardboard animals	3	Created 3D animals from cardboard
Interview with clients	1	Interviewed first-grade clients about their dream toys
Brainstorm with small group	2	Shared information gained from interviewing with clients and asked classmates for inputs

		about their design ideas.
Prototype	2	Made prototypes
Receive feedback from clients	1	Showed clients the prototype and asked for feedback
Complete final toy design	7	Revisited the feedback from clients and planned for improvements. Finalized toy construction.
Toy delivery and play date	1	Met clients for toy delivery
Post workshop interview with twelve builders	1	Interviewed the 12 builders about their experience in the Making and Engineering class.

Table 1. Structure of Making and Engineering class

## Results



Figure 1. from left to right. 1) Amy's prototype of orange emoji pillow inspired by her My Client Profile worksheet. 2) Amy's final project. 3) Amy and her client at the playdate, holding the card her client made.

We divide the investigation of artifacts made by fourth grade builders into three phases: (1) after the first client interview, (2) after the client feedback session, and (3) before a playdate with clients. We found 27 out of 41 students kept their original project ideas from phase (1) to phase (3). The 14 remaining students changed their toy ideas after phase (2) but still showed alignment to their clients' requests. Out of 41 projects, 40 projects aligned with what was requested by their first grade clients. Throughout the three phases, builders also made changes to their design to serve their clients' preferences. For example, Amy's client profile sheet suggested her client likes emojis: happy, hearts, and sparkly eyes. The client preferred the toy to be "kind of hard with a lot of stuffing and puffy." Amy made an orange emoji pillow from felt that was roughly sewn together as her prototype and showed it to her client for feedback. Her client liked the pillow and only asked if Amy could change the color of the fabric from orange to yellow and added "sparkly eyes" using pink and yellow fabric. On the final project, Amy took her client's feedback and made

a heart eye yellow emoji pillow. She also recorded her voice on a recorder module to play, “have a nice day!” once the pillow was squeezed (Figure 1).

Amy was one of the 27 builders who held onto their original toy design requested by the clients since the first client interview, making only minor changes. 14 builders completely changed their designs. These changes were made because of several reasons including difficulties in making original ideas (8 cases), feedback from clients (2 cases), materials constraint (1 case) and peer influence (3 cases).

<p>When we met a few months ago you told me your dream toy is a _____. [Hand over the toy] Here's a prototype I made of the dream toy you told me about! It's not the final toy I plan to make, but I wanted to show you what I had in mind so you could tell me if you think I'm on the right track. So play with it for a minute...</p> <p>1. What do you like about it? What don't you like about it?  <input type="text" value="It's a doll."/>  <input type="text" value="It is not soft."/>    </p> <p>2. Does it work like you expected? Does it look like you expected?  <input type="text" value="No"/>  <input type="text" value="not so fast"/>  <input type="text" value="Yes"/>    </p> <p>3. Is it close to what you imagined? If not, what is missing?  <input type="text" value="No"/>    </p> <p>4. What materials would you like the final toy to be made of? What size?  <input type="text" value="Beachy"/>    </p> <p>5. Any other thoughts or things you'd like to share with me so that I can make your dream toy?  <input type="text" value="Needs to be a brown bear with a bow tie with a tiny cardboard bed with wheels."/>    </p>	<p>When we met a few months ago you told me your dream toy is a _____. [Hand over the toy] Here's a prototype I made of the dream toy you told me about! It's not the final toy I plan to make, but I wanted to show you what I had in mind so you could tell me if you think I'm on the right track. So play with it for a minute...</p> <p>1. What do you like about it? What don't you like about it?  <input type="text" value="The doll."/>    </p> <p>2. Does it work like you expected? Does it look like you expected?  <input type="text" value="Nothing"/>    </p> <p>3. Is it close to what you imagined? If not, what is missing?  <input type="text" value="Nothing"/>    </p> <p>4. What materials would you like the final toy to be made of? What size?  <input type="text" value="Bigger wood"/>    </p> <p>5. Any other thoughts or things you'd like to share with me so that I can make your dream toy?  <input type="text" value="A house."/>    </p>
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Figure 2. Ruth (left) and Betty's (right) responses from their Client's feedback worksheet

Unlike Amy, whose client loved her design and only requested minor changes, 10 out of 41 builders indicated negative feedback. For example, Ruth answered “No” on her client feedback worksheet for the question: It is close to what [client] imagined? (Figure 2). Ruth’s client did not like her prototype at all. She made a pillow with a voice recorder that spoke “I love you, [name of the client]” when squeezed, but her client wanted a doll house. Ruth was discouraged and worried that she would not be able to make a doll house. She spent the next session listlessly looking at other projects and playing with materials. Her friends and teacher encouraged her to try to make the dollhouse. The teacher asked Ruth to cut plywood into five rectangular pieces and showed her how to assemble the pieces into a cube with one side open. Ruth was excited to see an initial structure of the doll house. However, the structure collapsed when she returned for the next session. Ruth was disappointed that she had to start all over again. Feeling discouraged, the teacher had to work closely with her and suggested she use a glue gun instead of masking tape. Once the structure was finished and had a strong foundation, Ruth knew exactly what to do. She picked up several colorful tubes of acrylic paint and started to paint her doll house (Figure 3). At the end of the class, Ruth said “I’m so proud of myself today!” When asked why, she answered “I worked so hard. I’m almost done!”

Like Ruth’s client, Betty answered “NOTHING” on her client feedback worksheet (Figure 2). Betty’s client did not like her prototype and it was “NOTHING” like what she expected. Betty intended her dollhouse to have two levels. But, she cut one piece of wood slightly smaller than the others so when she assembled her house together, it was slanted. She looked unhappy with

her design, so her classmate provided encouragement by saying that it looked “like a cool modern loft house!” Another agreed and said Betty could decorate her dollhouse as a fun, “whimsical witch house”. However, Betty still appeared unsatisfied and said that she would not continue her dollhouse project and would make a pillow instead. Seeing that Betty already poured in a lot of time and effort for her project (cutting and gluing wood), the teacher suggested that she take the second floor out and redesign her roof. Betty agreed and took out the top floor. She added a piece of plastic on the top to create a roof with skylight. She also made a loft floor for a bedroom (Figure 3). During the post interview, Betty told us that her favorite part of Bots for Tots was to see how surprised her client was to receive the toy she made. She said, “I liked when I gave it to my little sister. I like to see how like happy and like surprised she was.” Betty was proud of her creation, even though she almost changed her design to a pillow.



Figure 3. Ruth (left) and Betty's (right) final designs for their doll houses on the day of Play date.

Pillows were a popular choice among builders that did not pursue the original idea. While only one client originally requested a pillow, ten girls made pillows. For example, Panni told us during the post interview that her client originally wanted a stuffed animal that has a “head of shark with a dolphin body”. She tried drawing and cutting a shark’s head but she was not able to make it; she said “It was kind of hard.” So Panni asked her client if she could make her a pillow instead. As pink was her client’s favorite color, Panni made a pink polka dot pillow with rainbow mesh. She wrote her client’s name a side of the pillow. Out of ten pillows, nine showed personalization features specific to each client. Several personalized details were requested by the clients such as the clients’ initials, soft circuits, voice records, and sketches.

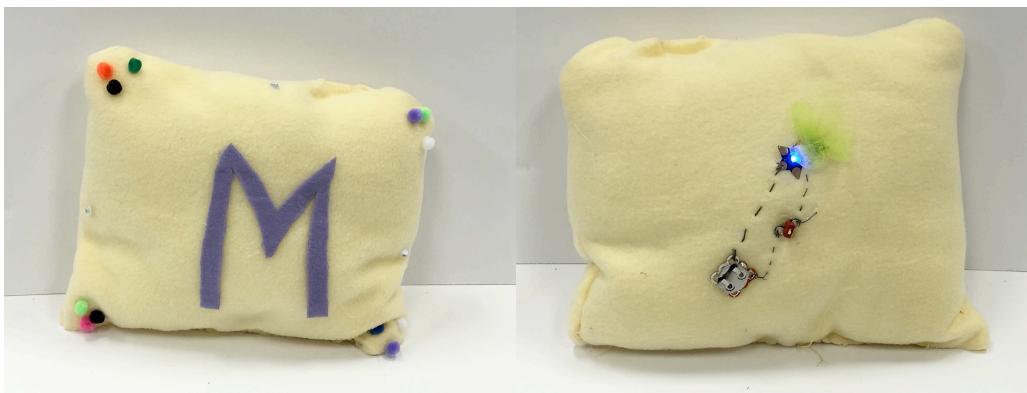


Figure 4. Lightbulb's pillow for her client (front and back)

One of the ten builders who made a pillow, Lightbulb, described her project as not a “boring pillow”. She decorated one side of her pillow with pompoms and an “M” for her client’s name. On the other side, she made a soft circuit where her client could “flip the switch a little star thing would light up” (Figure 4). She told us during the post interview that she felt like her client “wanted more than just a boring pillow”. She added that, “I wanted to do more for her, instead of just a pillow that said, [client’s name]. I wanted to make it special and personalized, that’s why I did the—because not a lot of people have light up pillows.” Since Lightbulb finished her project two weeks before the playdate, she decided to make a set of wooden blocks, a toy her client originally requested. She admitted that she made a pillow because she initially did not know what to do, “I just didn’t know what to do so I was like, why don’t I make a pillow.” She then realized that her pillow was not relevant to her client’s preference and recalled that her client liked to play with Lego bricks. She said, “well these [wooden blocks] are kind of like Legos, so maybe it would add something more to the project that [her client] would like.” Additionally, Lightbulb told us during the post interview that not only did she like making things, but she also liked seeing the reaction of her client after receiving the toys she made. She felt really proud as she “liked watching [her client] like play and enjoy the blocks.”

Lightbulb was not the only builder who felt proud when her client enjoyed her handmade toy. Out of 12 builders interviewed, 11 also said that they felt proud or happy when they saw that their clients liked their projects. For instance, Aditi said that she was happy when her client was hugging and playing with her bunny stuffed animal. LillyJane said that she liked seeing reactions of her client when she received the gift. Even though the making experience was challenging, it was really fun for her. Like LillyJane, Hailey thought that it was hard to know what her client liked but it was fun making for her client and seeing her love the personalized pillow. She said, “I really wanted to make something that she would remember and really love.” Sarah thought that her project was “not as hard as some other people’s” but she was still proud of herself for putting in effort and for satisfying her client’s requests.

Furthermore, the post interview data showed that the builders often talked about their clients even when they were not asked about them. Our first seven questions on the post interview protocol aimed to understand the builders’ feelings toward the Bots for Tots project and their perceptions on technology and craft. We did not ask the builders about their clients in these questions. 11 out of 12 builders talked about their clients unprompted in the first seven questions, six girls said that making toys for their clients was their favorite part of the class. For example, LillyJane told us that her favorite part was interviewing her client because it allowed her to know her client better and to personalize the toy for her. Hailey explained that her favorite part was helping her classmates with making and creating a toy that her client would love. Hailey liked prototyping so that she could receive feedback from her client and improve. Moreover, when asked about their feelings toward the toy they made or about things they would have liked to do differently seven girls mentioned their clients. For example, Erica answered that she “really, really liked” a colorful dollhouse she made. She then added, “and I think [her client] really liked it too.”

One girl, Aditi, mentioned her client on four out of seven unprompted questions. During her pre interview Aditi was timid and quiet often answering questions with, “I don’t know” and “Mmm-hmm.” However, in the post interview, she gave lengthy responses and often referred to her client. Aditi said that brainstorming session was the most challenging task because her client said “yes to everything” that it required extra work to come up with a project idea. Aditi ended up making a pink bunny stuffed animal with a letter “J” (her client’s initial) on its belly. She said that she enjoyed the making experience and it was fun designing for her client. When asked Aditi if in a future Bots for Tots project she would prefer to build for herself or for someone else, she said she would prefer making for someone else because the receiver would be surprised and happy. She would not enjoy the making experience that much if she were to make for herself.

Similar to Aditi, nine other builders interviewed would prefer making for someone else if they were participated in the Bots for Tots project again. Panni wanted to make for others because she loved hugs and the receivers often gave her hugs of appreciation. Another builder, Margie, explained that she wanted to make for others as she would try hard because she did not want her receivers to feel sad. Erica wanted to make for her parents and her good friends because she knew exactly what they liked. Nevertheless, five of them said that they also wanted to build something for themselves. The most common reason was that they felt proud of what they had made and wanted to keep it.

## Discussion

A goal of this study was to explore a pedagogical framework on how “making for others” can influence and engage girls in maker activities as well as exploring the emerging supports that the girls need throughout their making process. We wanted to provide an alternative way to create a more inclusive maker-centered learning environment that directly consider women’s values in cultivating personal and community connections. We also suggest that providing girls opportunities for social and emotional support is important in the design of maker activities and spaces.

### Making for others: Building toy, building relationship

Belenky and her colleagues (1986) suggested that women are likely to be driven by the desire to connect with others at a personal level. The school’s “Big Sisters-Little Sisters” program encouraged the fourth grade builders to build a year-long mentor-like relationship with their first grade clients. This intimacy and relationship with their first grade clients motivated the builders throughout their making practices. Apart from making toys for their clients in Bots for Tots project, the fourth grade builders also provide care and guidance to their client, as it was their first year of elementary school. They shared the same building and often met during recess and school activities.

While the Bots for Tots project was part of a formal school experience, activities and artifacts would not be graded. Nevertheless, the builders were motivated by their clients’ preferences, as 40 out of 41 projects showed alignment with what was requested by their clients. The builders took what they had learned from client interviews to come up with project ideas and more than half (27 builders) were committed to the original ideas throughout the year. In the 13 other instances where the builders could not carry out their original plans, they added personalized details for their clients. For example, in making pillows, the builders chose fabric based on their client’s choice of colors and often included clients’ initials, voice recording, and sketches. This is demonstrated by Lightbulb, who incorporated a soft circuit to her pillow because her client did not want “just a boring pillow.” She wanted to make her project special and personalized. Lightbulb was the only builder in the class who made the soft circuit. It was also her first time experiencing with the materials.

In addition, the post interview data showed that builders were constantly thinking about and referring to their clients even when they were not asked about them. They try to understand the other’s point of view and tend to position themselves through actions that bring them into connection with others (Galligan, 1982). The clients were important to the builders’ making experience. Making the toys for their clients connects and tightens the relationship between the builders and the clients. Interestingly, 11 out of 12 builders talked about their clients when discussed about their favorite parts of the Bots for Tots project and their feelings toward their projects. LillyJane’s favorite part of the class was interviewing and getting to know her client better so that she could make the toy that her client would love. While Panni regretted about the toy she made because she could not make the toy that was originally requested by her clients. The builders empathized and connected with their clients

The builders are particularly motivated by the social aspect in making and their desire to help or to give. They tend to feel a sense of accomplishment in making and often depend on personal and community connections (Intel Corporation, 2014). When asked whether the builders prefer building for themselves or for someone else if they were to participate in the Bots for Tots project again, ten answered that they wanted to build for someone else. The most common reason was that the builders felt happy when they saw that their clients appreciated their handmade toys. 11 girls interviewed talked about how seeing their clients like their toys made them feel proud or happy. For instance, Aditi was happy when she saw her client hugging and playing with the bunny stuffed animal she made. LillyJane also liked seeing her client's reactions when they received the gift. This finding confirmed how relationship and feelings were tied to the builders' motives in making.

#### Persisting through challenges: Motivated by clients, encouraged by peers and teacher

The feedback and reactions from clients toward the toys affected builders' feelings and confidence. The comments-- both positive and negative--prompted the builders to improve their designs. Builders made changes on their designs based on their clients' feedback. While 31 clients were satisfied with the prototypes, only requesting builders to make minor changes, ten of the builders received negative and discouraging feedback.

Despite the tough feedback, the builders overcame challenges and finished toys that satisfied their clients. They took comments that may be discouraging to improve their toys and ensured that their clients were happy. Here, the builders have higher tendencies toward being connected knowers and "learn through empathy" (Belenky et al., 1986, p. 115). For example, Margie's client told Margie that her pillow looked like a sausage, when her intention was to a tennis ball pillow after learning that her client liked to play tennis. Margie improved the design of tennis ball pillow and added a small tennis court made of wood, knowing that her client loved tennis. At the end of the project, Margie was proud of what she made and told us that her client also liked her toys. She said, "[her client] really liked the pillow. That's her favorite. She was like leaning on it." Despite receiving harsh comments on their prototypes, they tried to understand their clients' perspectives and made personalized toys to foster their relationship.

Nevertheless, negative feedback can also demotivate the young female builders, especially when the feedback came from a person who they had fostered meaningful relationship with. In a stressful situation, young female builders need close facilitation and emotional support from peers and teachers (Thotis, 1995). Sometimes, the form of support can be as simple as giving a compliment to the builders. Words of encouragement like: "I'm so proud of you today" or "I like the living space that you added here in your doll house. What are you planning to do on the top floors? Good job. You're almost done." As shown through the case of Ruth, who was emotionally affected by a comment which took her several weeks to recover from and get back on track. The teacher provided her with encouragement and guidance to regain her confidence. She spent the last four weeks (and even some extra time at home) to finish her two-story dollhouse. Ruth was proud of her work, and was also rewarded with her client's satisfaction and happiness. In another example, Betty was disappointed by her slanted two-level dollhouse and wanted to make a pillow instead. She received feedback and encouragement from her peers and teacher that the house looked "cool" and "whimsical". After this reassurance, she decided not to start a new project, but figured out a way to improve her existing one. The teacher supported her by reframing her project and her classmates supported her by providing encouragement, and easing her disappointment so that she was able to progress past this mistake.

Without close support, female builders may feel demotivated and may give up on their intended project. This was the case for Panni, who chose to make a pretty pillow instead of a disproportionate shark-dolphin stuffed animal. It was also the case for other builders who switched from their clients' original requests to a pillow. Though they made personalized designs for their clients, these builders lost confidence in their ideas, became demotivated, and wanted to settle on less complex designs.

## Conclusion

The intimacy and personal connection with their clients influence how the young female builders engaged in the processes of making. This connection with their clients make the construction process “personally meaningful”, because the person for whom they were building was meaningful. Though these young builders have not yet developed to the “connected knowers” stage as defined by Belenky and her colleagues (1986), they have a tendency to value social interactions and a sense of community. Making for others is an effective exemplar of how we can leverage an epistemological approach that is cognitively and culturally unique to women in order to motivate female learners in making.

However, it is not enough to merely provide a space for girls to make. How we design the learning experience matters. The teacher needs to provide support. At the same time, facilitation and activities should also be designed to build a community of learners that supports one another. A better understanding of the values of diverse learners that make up our schools and makerspaces must be considered in order to create an inclusive maker-centered learning environment.

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