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Listening to the Girls: Participant Perceptions of the Confidence-Boosting Aspects of a Girls' Summer Mathematics and Technology Camp

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Females, students of color, and students of low socioeconomic status (SES) are often underserved or marginalized in mathematics education. However, some instructional approaches and intervention programs have been shown to educate these students more equitably. This study examines how girls of diverse racial/ethnic and socioeconomic backgrounds perceived the characteristics of one such intervention program as inspiring the development of greater confidence in their mathematics skills. This article explains the similarities and differences of the perceptions of each group, as well as the implications for classroom environments and further research.

Mathematics serves as a powerful gatekeeper in the American culture (Moses & Cobb, 2001; Schoenfeld, 2002). In our increasingly quantitatively and technologically oriented society, an individual's level of mathematics understanding can affect his or her ability to function effectively as a consumer and as a citizen (Carnevale & Desrochers, 2003; Meier, 2003; Orrill, 2001). A student's understanding of school mathematics and the ability to demonstrate that understanding influences opportunities for K-12 school progress, undergraduate and graduate college attendance, and access to many careers (Moses & Cobb, 2001; Parrott, Spatig, Kusimo, Carter, & Keyes, 2000).

On standardized tests, mathematics achievement varies among selected student groupings, such as those formed by race/ethnicity, socioeconomic status (SES), and gender. Scores on these tests, including the National Assessment of Educational Progress (NAEP), Scholastic Assessment Test (SAT), and Graduate Record Exam (GRE), reveal that, as early as grade 4, both students of low SES and those who are African American, Hispanic, American Indian and Alaska Native are likely to have lower scores in mathematics than White or Asian American students or students of higher SES. The differences in achievement scores for these groups increase with age. On the 2006 NAEP, by grade 8, Hispanics, Native Americans, Alaska Natives, and African Americans scored 26%, 25%, and 30%, respectively, lower than their White counterparts in achieving or exceeding proficiency levels. Students of low SES scored 26% lower than those of higher SES. Additionally, in both grades 4 and 8, females scored statistically lower than males in most areas of mathematics (Lee, Grigg, & Dion, 2007). Although these score differences are small (1 to 5 points), the differences grow on the college and graduate school examinations used for school admissions. On the quantitative portions of the 2006 SAT, females' scores were 34 points lower than males; on the quantitative portion of the 1999–2000 GRE, females' average scores were 97 points below males (National Center for Fair and Open Testing, 2007).

In addition to lower scores, females are also more likely to have negative attitudes toward mathematics than males (Goodell & Parker, 2001). Even when girls and boys have equivalent test scores, girls indicate lower levels of confidence than boys, and they are more likely than boys to attribute failure to lack of ability (Vermeer, Boekarts, & Seegers, 2000). While the issues of inequities in mathematics, science, technology, and engineering exist for girls of all racial and SES backgrounds, they may be more severe for girls of color and girls of low SES (Daisey & Jose-Kampfner, 2002; Lim, 2004; Parrott et al., 2000; Thompson, Smith, & Windschitl, 2004). For these

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reasons, girls of color and/or low socioeconomic status face double or even triple jeopardy in being successful in mathematics.

Many authors describe changes in educational methods that can help to address these inequities (Gavin & Reis, 2003; Gilbert, 2001; Gilbert & Gilbert, 2002; Goodell & Parker, 2001; Perez, 2000). In particular, numerous authors have described informal interventions that helped female students develop greater confidence, motivation, and achievement (Karp & Niemi, 2000; Parrott et al., 2000; Peterson, 2004; Wiest, 2004). One such intervention program is the Girls Math & Technology Camp, which is available to Northern Nevada middle school girls. The main component is a five-day residential summer camp held on an urban university campus. The girls who attend this camp come from urban and rural areas, and they have a broad range of socioeconomic backgrounds and mathematics skills. In Wiest's 2004 study, this camp was shown to improve participants' confidence, knowledge and skills, motivation, and effort in mathematics.

Of these program outcomes, one area that is worthy of deeper research is the positive effect on participants' confidence in mathematics. Confidence, which some authors equate with self-esteem (Erkut, Marx, Fields, & Sing, 1998), can be considered in general terms or in terms specifically related to a subject area such as mathematics. Mathematical confidence is believed to help girls with perseverance and independence in their mathematical efforts, as well as their anticipation of success as an outgrowth of ability–anticipation that in turn improves achievement (Fennema & Peterson, 1985). For these reasons, the impact of a mathematics intervention program on participant confidence warrants more in-depth study.

Although many studies that discuss impacts on student confidence and self-esteem do not differentiate the research results according to race/ethnicity or SES (Karp & Neimi, 2000; Peterson, 2004; Wiest, 2004), a few do identify factors of race/ethnicity and/or SES as salient (Birenbaum & Nasser, 2006; Erkut, Marx, & Fields, 2001; Erkut et al., 1998; Greene & Way, 2005; Lim, 2004; Parrott et al., 2000). In particular, these studies suggest that levels of self-esteem and factors that contribute to confidence vary according to race/ethnicity and SES. Birenbaum and Nasser (2006) demonstrated that ethnicity and gender contribute to students' attitudes toward mathematics and discussed the possibility that an ethnic group's cultural standing within a society plays a part in students' attitudes. Similarly, Lim (2004) suggested that the girls of color and low SES backgrounds in the classroom she observed had particularly fragile levels of confidence and motivation in mathematics. These levels of confidence and mathematics were easily eroded by the White middle class teacher's instructional approach and the caring she showed to White middle class students that she did not extend to students of color or low SES.

Therefore, the following questions are of interest: How does an intervention program impact the mathematics confidence of girls with different racial/ethnic and SES backgrounds? What similarities and differences do girls of different racial/ethnic and SES backgrounds express about the characteristics of the program? What do these similarities and differences suggest about the kinds of instructional approaches within which girls of color and low SES feel most comfortable and validated?

Background of Study

This section begins with a discussion of situated learning theory as the theoretical framework for this study. The discussion includes commentary on the kinds of issues females confront in mathematics, particularly if they are students of color or of low SES. Finally, the Girls Math & Technology Camp (hereafter referred to as "Math Camp"), from which participants for this study were drawn, is described.

Situated Learning Theory

In his discussion of situated learning, Wenger (1998) discussed the process of creating a sense of identity within a community. In this community context, learning takes the form of moving from a position of limited understanding of, responsibility for, and participation in the community activities to increasing levels of understanding, participation, and responsibility. Learning is thus a process of transformation both in the individual's role or identity and in the way that the individual interacts with others in the community.

Although a person's identity is always evolving, Wenger's description suggests that the interaction between an individual and the communities in which she or he is involved plays an essential role in that evolution. In the case of the girls who participate in a particular mathematics intervention program, they bring both the history of their prior mathematics learning experiences and the values, beliefs, and experiences that are part of their personal, family, and cultural backgrounds. Past experiences and resulting attitudes and beliefs interact with elements of the new environment to create unique directions for each girl's identity development as a mathematics student. In particular, student perceptions of themselves and others in terms of mathematics competence, comfort level with mathematical tasks presented, and sense of connection with others in the mathematics learning environment all play a part in their sense of identity as a mathematics learner. Wenger (1998) notes, "Engagement in practice gives us certain experiences of participation, and what our communities pay attention to reifies us as participants" (p. 150). For this reason, different learning environments are likely to leave students with different perceptions about their identity as mathematics students. "We know who we are by what is familiar, understandable, usable, negotiable; we know who we are not by what is foreign, opaque, unwieldy, unproductive" (p. 153).

Marginalizing Characteristics in Mathematics Classrooms

As described above, situated theory suggests that learning does not occur in an isolated, individual form, but that the context of the learning plays an essential part in determining the knowledge that is acquired (Boaler, 2002a; Lave & Wenger, 1991; Thompson et al., 2004; Wenger, 1998). For example, Boaler (2002b) explained that the difficulties some females experience in mathematics, such as anxiety and lack of confidence, are not inherent female qualities but are instead often engendered by the nature of the classrooms in which they learn mathematics. Similarly, she suggested that those who believe that students of color or low SES struggle because of qualities inherent in their race or culture ignore the ways in which some methods of teaching mathematics disenfranchise or exclude these students from equitable learning opportunities. Wenger (1998) described situations such as these as keeping some participants in "marginal positions" (p. 166) that essentially close the possibility of success. For these reasons, it is important to consider the classroom qualities that may offer greater support and learning opportunities for females, particularly females of color and/or low SES.

Both teaching methods and teacher attitudes in mathematics classrooms can pose problems for many students, particularly those in marginalized groups. Boaler (2002b) discussed girls' desire for conceptual and connected understanding that is thwarted when they are taught mathematics in traditional ways, e.g., using direct instructional approaches, individual competition, procedural emphases, decontextualized and meaningless problems, and lecture and demonstration rather than hands-on approaches. The result of this mismatch between girls' interests and the instructional approach led to disinterest in continuing studies in mathematics. Similarly, Schoenfeld (2002) cited several studies that demonstrated that when students of color and low SES were taught mathematics in a way that did not connect with their lives or the real world, they often failed and/or discontinued taking mathematics courses. In contrast, when they learned mathematical concepts with an instructional approach that emphasized connections with their experiences and world and communication about these concepts, students of color and low SES were more likely to find academic success.

Similarly, teachers often convey lower expectations for and stereotypes about students of color and low SES (Daisey & Jose-Kampfner, 2002; Parrott et al., 2000; Rousseau & Tate, 2003). This may be particularly true for females in mathematics classes (Gavin & Reis, 2003; Lim, 2004). When students are aware of these lower expectations and stereotypes, their ability to learn or find success in mathematics is compromised (Johns, Schmader, & Martens, 2005; Quinn & Spencer, 2001). Perhaps even more noteworthy, teachers' beliefs about students' ability to achieve success in mathematics may result in students' assignment to lower-track classes that are often inferior to higher tracks in methodology and content (Achinstein, Ogawa, & Speiglman, 2004; Gamoran, 2001; Parrott et al., 2000). Moreover, some White and middle class teachers do not establish the same rapport or positive, nurturing relationships with their students of color or low SES that they do with students with whom they share a similar racial/ethnic and class background (Lim, 2004).

Intervention Programs

Several researchers have described intervention programs such as after-school or weekend programs or summer camps that were particularly successful with girls (Gavin & Reis, 2003; Karp & Niemi, 2000; Peterson, 2004; Volpe, 1999; Wiest, 2004). By occurring outside of school, these programs generally have the benefits that students participate by choice and the activities involve little or no pressure related to grades, tests, or time constraints. For these reasons, female students often find these programs less threatening than the traditional classroom, allowing them the opportunity to move beyond potential mathematics anxieties and toward greater risk-taking (Gavin & Reis, 2003). Participation in these intervention programs often results in increased comfort with mathematics, including confidence, motivation, engagement, and achievement (Thompson et al., 2004).

The Girls Math & Technology Camp

The camp attended by the girls interviewed in this study was held in Northern Nevada. As described above, the program centers on a five-day residential summer camp for girls who will enter grade 7 or 8 the following fall. The goals of the camp are to improve girls' knowledge, skills, dispositions, and participation in mathematics and technology. Although past research has shown that the camp has impacted all of these areas, the largest and most consistent impact has been in the area of the girls' dispositions (Wiest, 2004).

Advertising for the camp is sent to all public, private, and Native American schools in Northern Nevada. The participants have a wide range of mathematics ability as well as SES and race/ethnicity (Wiest, 2004). Free and reduced lunch status was used as an indicator of low SES. Instead of paying the full $350 cost of the program, girls paid $25 if they qualified for free lunch and $50 if they qualified for reduced lunch. In 2004, there were 29 girls entering grade 7 and 5 girls entering grade 8. Table 1 shows a breakdown of 2004 participants by race/ethnicity and participation in free/reduced lunch.

Table 1

2004 Participant Demographics

SES Indicator	Girls of color	White girls
Received free/reduced lunch	6	6
Did not receive free/reduced lunch	5	17

Topics studied during the week include problem solving (2.5 hours), spatial tasks (1.5 hours), geometry (7.5 hours), data analysis and probability (younger girls only, 7.5 hours), and algebra (older girls only, 7.5 hours). The girls also participated in 4.5 hours of computer classes designed to support the mathematics objectives, and they used four-function and/or graphing calculators as mathematics tools. Most work was completed in cooperative groups, changing members daily. Key pedagogical strategies included hands-on activities, mixed-ability cooperative group work, real-world applications, and problem solving and investigation in a supportive learning environment. For example, geometry lessons began with group conjecture, discussion, and debate about the sums of interior and exterior angles of triangles, based on triangles the girls drew. (See Figure 1.) Subsequent geometry lessons included identifying and discussing other patterns in angles of geometric figures as well as using models to identify patterns in the numbers of vertices, edges, and faces in prisms and pyramids. Other hands-on activities and group work included data analysis lessons in which the girls found the mean, median, and mode of their heart rates.

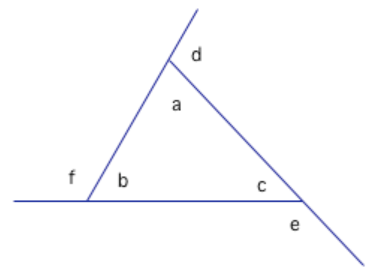

Figure 1. Example of problem used for group conjecture and debate in a geometry lesson. Angles a, b, and c are interior angles; angles d, e, and f are exterior angles. The girls were asked to make and defend conjectures about patterns in the sums $a+b+c$ and $d+e+f$.

In addition to the lessons conducted at the camp, the girls were provided with female role models. Role models at the camp included program staff members and a guest speaker who uses mathematics and/or technology in her job. The girls also learned about historically famous women in mathematics and computer science.

Context and Methods

Research Design and Researcher Role

For this study, the first author chose girls from the attendees at the Math Camp according to their racial/ethnic and socioeconomic background. In contrast to Wiest's 2004 study, more in-depth interviews were conducted to focus on the impact the camp had on girls' confidence in mathematics. Two semi-structured interviews were conducted with each of these girls. The first interview occurred within two weeks after the camp, and the second occurred approximately six months later. These interviews generally occurred at the girls' homes or at another location that was convenient for the participants. In a few cases in which the participants lived in a remote rural area, the interviews were conducted by phone.

The first author had been the Math Camp Program Assistant and one of the instructors, so both the girls and their parents were familiar with her. This role allowed her to establish rapport with each of the girls before the interviews. It is possible that this familiarity could have influenced this author's interpretation of the girls' responses, although the interviews were the only extended conversations she had with them.

Participants

Using stratified sampling, 16 girls were chosen from the Math Camp participants with four from each of the following groups: girls of color who received free or reduced lunch, girls of color who did not receive free or reduced lunch, White girls who received free or reduced lunch, and White girls who did not receive free or reduced lunch. The presence or absence of participation in free or reduced lunch was used as a convenient indicator of socioeconomic status because these data were readily available. However, a variety of circumstances shifted the number of participants. For example, because one girl chosen for the study carpooled with another girl who was not chosen, the request was made and granted to include both girls. One girl of color, who was identified as a person who did not receive free or reduced lunch, was later moved to the group of girls of color who received free or reduced lunch. This change was made because it was found that the free or reduced program did not exist at her reservation school. Because her family could not afford to pay the tuition, her fees had been paid by the Native American community of which she was a member. Finally, one higher SES girl of color declined to participate in the second interview. The demographic breakdown of the participants who were included in the study is shown in Table 2.

Table 2

Research Study Participant Demographics

SES Indicator	Girls of color	White girls
Received free/reduced lunch	6	5
Did not receive free/reduced lunch	3	5

Data Gathering Procedures

Two interviews were conducted with each girl. Each interview lasted approximately one hour. The interviews were recorded and later transcribed. The open-ended questions included questions about the effect Math Camp attendance had on the girls' dispositions toward mathematics and their school mathematics classes, as well as on strategies they use for dealing with problems in mathematics. These questions were designed to provide data about how and why the Math Camp experience might have had an effect on students' confidence as mathematics learners. The intent was to determine if there was a change in the girls' confidence about their mathematics work, including evidence of increased optimism about their work in mathematics classes and their perseverance and ideas about available resources when they encountered difficult problems.

The following questions were posed.

1. (One month and six months after camp) Did attendance at Math Camp have an effect on your confidence in mathematics? If so, why? What qualities of Math Camp helped you feel more confident?
2. (One month after camp) How do you feel about going to your math class in the fall? Do you think going to Math Camp had an effect on this? Why or why not?
3. (Six months after camp) How confident do you feel about math class this year compared to last year? Do you think going to Math Camp had an effect on this? Why or why not?
4. (Six months after camp) If you are having difficulty in math or with a specific problem, what do you do? How do you address the problem? Has that changed since you went to Math Camp? If so, do you think Math Camp had an effect on that? If so, why?

Data Analysis Procedures

Interview responses were coded using a grounded theory approach (Ryan & Bernard, 2000). Lists were made of specific ideas mentioned by individuals, such as comments about cooperative group work, and were compared to similar comments made by other girls. These responses were categorized according to the racial/ethnic and SES groups to which the girls had been assigned. The data were then examined to discover trends in the frequency of these responses, either across all groups or by racial/ethnic group and SES status. Responses that seemed especially salient to the impact of the camp or the girls' experiences in learning mathematics, even those made by only one or two girls, were also noted.

Results

In the first set of interviews, 16 of the 19 participants said that Math Camp attendance had increased their confidence in mathematics in general and in regard to their fall mathematics class participation. In the second set of interviews, all 19 said that Math Camp had improved their confidence. In elaborating on this improvement, one girl said, "Last year I wouldn't attempt [math]. This year I'm getting a little better at it. Algebra is easy." Another said,

> I think I feel more successful because, like before, I didn't think I could like get anything right in math, but after going to math camp, and after explaining it and everything to me, I feel like I can mostly do anything now.

The qualities of the Math Camp experience that each group believed had positively impacted their confidence are discussed below. Because of the open-ended nature of the questions, mention of a topic by two or more girls was used as an indicator that it warranted attention. Common topics across all groups included teaching methods, curriculum, and peer interactions. Differences among groups were noted in participant comments about the value of particular curriculum topics or experiences and of group presentations (sharing small group work in a whole-class setting), as well as strategies used when facing difficulties in mathematics work.

Common Topics Across All Groups

Some topics arose in all groups, regardless of racial/ethnic or socioeconomic background. As mentioned above, these themes were related to instructional methods, curriculum, and peers. Regarding the instructional methods, 43% of the girls reported that their confidence was positively affected by the focus on cooperative group work. These girls explained that they appreciated the way that group work helped them see different approaches used by other students. One girl stated that this atmosphere helped her feel more confident

> because in math camp, we had hard questions and we had to try it out a lot of times ... and everyone did it a different way ... now I know there's more ways to figure out one answer instead of just like giving up and just saying I can't do it.

The girls also mentioned feeling that they shared common attributes and experiences with other girls in their groups, such as similar abilities and difficulties in mathematics, which contributed to their confidence. These feelings were also expressed by girls who had noticeably higher skill levels than many of those with whom they had worked, as implied in the following comment.

> I think that Math Camp built up my confidence because, at one point in time, I felt like I was the only person who didn't understand math in a way, and then I met *all* these other girls who were having trouble or not having trouble in the same areas that I was and it was just really nice to know that there were other people out there who were just like me.

Another girl said, "I can understand what I'm doing more and see what mistakes I'm making. ... I knew I wasn't the only one having trouble, so I wasn't afraid to work on it." These and similar comments indicated that a sense of commonality with others was reassuring and helped the girls feel more confident, even when they did not immediately know how to solve a problem; this confidence directly impacted their perseverance. The Math Camp environment gave the students an opportunity to take the risk of acknowledging what they did not understand or found difficult without any negative repercussions. One girl accompanied her comments on this topic by expressing appreciation for the way other students helped her when she had difficulty, explaining that her friends at school just told her the answers, but these girls helped her to understand *how to do* the problems.

Among those who mentioned the curriculum, 42% spoke specifically about the hands-on geometry lessons, which, as described above, included drawing and using manipulative models as the basis for making conjectures and debating angle measures and relationships. The girls said that they felt these lessons contributed to their improved confidence and understanding because the lessons were "fun" and allowed them to develop an understanding of terms that were new to them or for which they had not grasped the meaning in their previous studies.

As stated above, these comments were made across all groups and seemed to reflect the girls' appreciation for an atmosphere in which they felt a connection with the others in the group rather than feeling isolated or in competition with them. Additionally, their comments about geometry indicated that they enjoyed the chance to learn, in a hands-on way, about a topic that they either had not learned or had not mastered in the past.

Differences Between SES Categories

Examining the comments by SES categories, some patterns in the girls' views of the instructional methods and curriculum were noticeable, including specific teaching techniques and curriculum topics. Students who received free or reduced lunch were more likely (100% versus 50% of the other girls) to mention the benefit of revisiting topics they had learned previously, often explaining that they felt they developed a higher level of understanding or "refreshed their memory" in a helpful way. More of these girls (64% versus 13% of the other girls) valued the opportunity to present their group's ideas in front of the class, explaining that this also helped them increase their confidence, in part because it was another opportunity to see and share different approaches to the problems. One said she liked "the way you would have us in groups and then we'd share it with the class." When the researcher asked, "Any idea why that made you more confident?" she replied, "Well, you get more answers and you see how other people have their point of view about the problem." The frequency of these girls' verbalized preference for making presentations to the group contrasted with some of the same girls' discomfort in doing so at the beginning of the camp. According to the girls' comments, this discomfort disappeared quickly, indicating that they found participation in the presentations to be a positive experience.

Math Camp participation also appeared to affect the strategies used and the confidence of girls of low SES in confronting difficult problems when they returned to school. When asked how they handled difficulty with a problem after attending the camp, this group of girls was more likely than the others (36% versus 0%) to rely on their own strength and insight, rather than teachers or peers, as the first resource. They explained that they did not immediately ask for help, but first tried other approaches. One girl stated,

> I read over the problem to see if I understand it, kind of look at it in a different way, and that sometimes helps me understand the problem better. Math Camp affected me ... because it has made it so that I feel that I'm not so frustrated any more about the problems I don't understand at first because I know that if I just keep looking over it, I'll eventually understand it.

In her comment, this participant indicated that she changed from feeling frustrated by difficulty to believing she had the capacity to understand difficult problems if she just took more time. Thus, she believed the camp experience increased her optimism about and perseverance in mathematics.

In contrast to the girls from low SES backgrounds, students in the higher SES group made fewer such comments. These students were more likely (50% versus 0%) to turn to the teacher as a first resource when they encountered difficulty, rather than using their own resources as discussed by the low SES group.

Differences by Race/Ethnicity and SES

Some trends by participants' race/ethnicity were evident in the comments. These trends came from the girls of color who were also of low SES, rather than coming from all girls of color. For example, 2 of the 6 girls in this group discussed, at length, the different mathematics teaching methods they had experienced at Math Camp and in class. They were explicit in explaining that they were much more interested in active, hands-on learning than in transmission models of instruction. One girl explained:

> Like our teacher ... he just like starts talking and talking and talking, and it's all dark, like he has his little projector or whatever ... it makes you want to go to sleep. My last teacher, she will explain it to us and she'll get things to show us and she had a *lot* of projects…. We'd actually do [a] survey, asking people … which was a lot easier to learn than just sitting there.

In terms of curriculum topics, 50% of the girls who were racial/ethnic minorities and receiving free or reduced lunch reported that they had difficulty with word problems in mathematics class. However, other girls in the same group commented that they were more confident doing word problems after extensive practice with them at Math Camp.

Fewer similarities were evident among the White girls (of both SES groups) who attended the camp. Interestingly, in describing qualities of the camp that improved their confidence, this was the only group to mention learning to use graphing calculators (30%). Also, this group of students, like the group who were not low SES, commented that they were more likely to turn to the teacher as a resource when they had difficulty with problems.

In summary, all girls valued cooperative group work, including the sense of commonality with their peers that they experienced in that setting as well as the study of geometry. The girls of color and low SES groups were more likely to talk about the value of participating in presentations, having the opportunity to review topics they had studied before, and learning through active, hands-on lessons. Each of these experiences at the camp was identified as helping them to improve their mathematical confidence. They also felt they had gained more confidence in their ability to be self-sufficient in resolving difficulties. In contrast, White girls and those who were not low SES said they were more likely to rely on the teacher for help, and White girls were more likely to express the idea that learning about graphing calculators increased their confidence.

Discussion and Closing Thoughts

Returning to the research questions, this study examined how and why the positive effects of Math Camp impacted girls' confidence and whether there were differences in the girls' perspectives corresponding to race/ethnicity and SES. A secondary focus was placed on the implications that the girls' perspectives had for the kinds of learning communities in which they felt most comfortable and validated. Although the small number of girls in this study and the unique characteristic of voluntarily participating in a summer mathematics and technology camp limit generalizations that apply to other populations, the results suggest many interesting considerations worthy of further exploration. In particular, when comparing the girls' comments about factors that improved their mathematical confidence across the different demographic groups, both the common and differing responses made by the girls offer insight into the aspects of the camp experience they valued and perhaps found unique in the camp learning environment. Based on these comments we suggest directions for further study in order to understand why specific characteristics stood out to particular groups of girls.

Several participants across all groups discussed the confidence-boosting impact of working with peers with whom they felt they had things in common. These comments suggest further investigation into middle grades girls' perceptions of the characteristics they do or do not share with other members of their school classes and reasons why the camp experience may provide a greater sense of commonality with their peers than they had experienced in their classrooms. For example, did the prevalence of small group discussion as a means of generating conjectures and debates among different small groups at the Math Camp allow for beneficial sharing of perspectives that increased these girls' sense of commonality? Boaler and Staples (2005) observed similar effective small-group work at a school with high proportions of students of color and low SES. Their work indicates that the girls' positive experiences at the camp were not unique to that setting but can be created in classrooms by emphasizing students' multidimensional skills and reliance on each other.

In terms of curriculum, many students in all groups valued the opportunity to study geometry. One girl commented that she had never studied geometry before, and others made comments that suggested, that although they may have studied geometry in the past, they found the math camp instructional approach particularly enjoyable and memorable. This result suggests the benefit of further study of the way girls compare their school and camp experiences of learning geometry, particularly the amount of time they spent on the topic in their school classrooms and the nature of the lessons.

Girls of low SES valued the opportunity to present their thinking in front of the class, in spite of the fact that some of the girls had initially been uncomfortable with this idea. The value they placed on these presentations suggests that further studies might examine how girls of varying SES backgrounds compare their experiences of presentations in front of their school classes with their experiences in Math Camp. Further research may reveal reasons why girls of low SES, more than other girls, were initially uncomfortable but later excited about the presentations.

The low SES group found particular value in review opportunities. One hypothesis for this outcome would suggest that these girls did not feel they had fully mastered the ideas before this review. Therefore, future studies might examine reasons why review would be particularly helpful to girls of low SES–and more valued by them than by girls of higher SES. Was the review helpful because it was presented in a different way than the manner in which they had originally learned the material? Had they not mastered the ideas the first time they had been exposed to them? Or did they perceive reasons why it was especially important for them to master this material that other girls did not echo?

The students of low SES were more likely (than the girls of higher SES) to describe themselves as more self-reliant in their mathematics work after attending Math Camp; the higher SES students continued to turn to their teachers for help. Additionally, the lower SES girls made comments that suggested they had increased confidence in their ability to understand difficult problems on their own after attending Math Camp. These results suggest the value of learning more about the resources students of low SES perceive are available–or not available–to them, as well as the importance they place on resolving issues on their own rather than relying on others and the reasons for this priority. Because girls of higher SES were more likely to make comments about turning to their teachers for help when they encountered difficult problems, future research might examine if there are differences in the ways students of varying SES experience their teachers' availability for help. This research may also investigate whether there are other reasons why one group might be more likely to depend on their own perseverance while another turns to the teacher.

Some girls of color and low SES described word problems as difficult in school. In contrast, other girls of color and low SES explained that they gained confidence in their ability to problem-solve with word problems through their Math Camp experiences. Therefore, it would be valuable to pursue greater understanding of the differences between the experiences. Were the types of word problems different? Or was the environment in which they completed them different?

Two girls of color and low SES provided extensive descriptions of classroom environments they found boring–namely, the situations in which the teacher stood at the overhead lecturing or demonstrating–in contrast to their experiences of conducting surveys and using these surveys as a foundation for their mathematics studies. Therefore, future studies might examine whether this perception is unique to girls of color and low SES or if other girls share the same perception. Are different types of instructional approaches more or less engaging for different groups of girls? Some studies suggest that girls are particularly likely to benefit from mathematics that they find engaging and meaningful (Boaler, 2002b; Boaler & Greeno, 2000). Are the benefits even greater for girls of color and low SES?

Only the White girls who were not identified as low SES made comments about the value of learning how to use graphing calculators and that this learning contributed to their confidence. Therefore, it would be beneficial to understand more about the reasons why only this group named this aspect of the camp experience. Are there reasons why these girls would value the use of graphing calculators more than the girls of color or of low SES? Or are there reasons why the experience might have been more accessible to them? How much do girls of color or low SES see graphing calculators as an important part of their future school or life experience?

Although this study was limited in the number of participants, the results of this study and the suggestions for future study echo the results of other similar studies of instructional approaches that have been successful with females, students of color, and students of low SES (Gavin & Reis, 2003; Gilbert, 2001; Gilbert & Gilbert, 2002; Goodell & Parker, 2001; Perez, 2000). Clearly, as described by advocates of situated theory, the interplay of student characteristics and the learning context has an important role in how students perceive and what they gain from their learning experiences. If students participate in an environment that promotes a sense of themselves as capable mathematicians and aligns with their sense of identity in such a way that they gain confidence in their abilities and interest in the subject matter, they are likely to learn more and achieve success in their learning. For example, Boaler and Greeno (2000) described how students who experienced different instructional methods in their mathematics classroom were influenced to see mathematics (a) as abstract and demanding obedience and perseverance or (b) as both a creative and cooperative endeavor and a subject that was connected with their world. Students who viewed mathematics in the second way were much more likely to perceive mathematics as important in their lives. They valued mathematics and intended to continue their study of it because their view of mathematics aligned with their views of themselves and their futures.

As described above, the comments made by the girls offer multiple directions for further study, particularly in terms of the ways that girls of different race/ethnicity and SES experience both the school classroom and a summer intervention program. Other factors also suggest further research agendas. For example, although this study combined girls of color into one group, Hispanic, African American, and Native American girls may have been impacted differently from attending the camp due to cultural or individual characteristics, and Asian girls–who were not part of this study–may have perspectives that differ from both White and minority-status groups. Similarly, English Language Learners may also have unique perspectives. Additionally, students with homes in rural or urban areas may have different perceptions and experiences. Each of these factors may affect students' confidence levels and perceptions of their camp experience and are worthy of additional study.

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