



Gender Equity in Mathematics Education

Gender equity in mathematics education is a complex issue. Although males and females take similar mathematics classes and achieve similar scores on standardized tests throughout the K–12 school years (Kimball 1989; National Science Board 1998), males' participation in mathematics after high school is far greater than females' (National Science Board 1998). Many educators are studying the K–12 school experience in an attempt to understand gender differences in mathematics participation. For example, as we make advancements in assessing children's thinking, we are starting to find gender differences in young children's mathematics achievement. In a large study of first through third graders, in which individual interviews were used to assess children's thinking, researchers found gender differences in children's solution strategies (Fennema et al. 1998). Other researchers are asking teachers what information they can offer to advance our understanding of gender equity in mathematics.

I interviewed elementary school teachers to see how they address the problem of gender equity in mathematics education (Levi 1995). Although all the teachers whom I interviewed believed that they had a role in addressing gender equity, their responses revealed a range of beliefs about actions that they could take to increase equity in females' and males' learning of mathematics. As I listened and worked to understand these teachers' ideas, I found myself reexamining and redefining my own beliefs. Just as we can learn about mathematics by working with others, so can educators learn more about addressing the problems of gender equity by regularly discussing these issues among themselves.

Discussing the problem of gender equity can be particularly difficult. Even when we

have time for such discussions, we might assume that others believe as we do; but if we suspect that others hold different beliefs, having such a discussion might be awkward. Unfortunately, it is difficult to improve our problem-solving skills if we are working and thinking in isolation. What follows are descriptions of three different roles that teachers play in approaching the issue of gender equity. These "roles" became evident during the course of the interviews. I hope that reading about these perspectives will help you reexamine how you solve the problems of gender equity in your classroom. These perspectives might also give you some impetus to discuss this issue with your colleagues.

Teachers' Roles in Addressing Gender Equity in Mathematics

All the teachers whom I interviewed were deeply concerned about gender equity in mathematics and believed that they had a responsibility to address this issue. They talked at length and in depth about their philosophies, their policies, and specific actions that they took in their classrooms. Clearly, these teachers saw addressing gender equity as a complex problem. The following paragraphs describe the three overall roles that these teachers play in confronting this issue.

Linda Levi

Linda Levi, llevi@facstaff.wisc.edu, works with the Wisconsin Center for Education Research, Madison, WI 53706. She studies teachers' understanding and the development of young children's thinking.

Edited by Anne Reynolds, areynolds@ou.edu, University of Oklahoma, Norman, OK 73019, and Jim Dorward, jimd@coe.usu.edu, Utah State University, Logan, UT 84322. Readers are encouraged to send manuscripts appropriate for this section to "Research into Practice," NCTM, 1906 Association Drive, Reston VA 20191-9988.

Role 1: Provide equal opportunities and respect differences

Some teachers believe that their role in addressing gender equity is to provide equal opportunities and to respect differences in the classroom. For example, one third-grade teacher made this comment:

I think everybody should have an opportunity to try and see if they like math, but if they don't like it, they don't like it.... I do think boys do some things differently than girls do. A lot of things.... It's not a problem that boys and girls are different. I don't push them to all be the same.

These teachers monitored their behaviors to ensure that they gave girls and boys the same types of opportunities to learn mathematics and participate in mathematics activities. These

teachers were not concerned, however, if boys tended to participate and excel in mathematics and girls chose other areas.

Many of these teachers thought that the biggest problem with gender inequity in mathematics is that society tends to value activities in which males participate over activities in which females participate. Expertise in mathematics is valued over other skills not because it is inherently more valuable than these other

skills but because the discipline is dominated by males. Following this argument, the reason that childcare workers are paid less than engineers is not because engineering is more important than caring for children but because engineering is a male-dominated field and childcare is a female-dominated field. Working for gender equity in this belief system means working to increase the value of fields that are typically dominated by females. Society should not require girls to excel in mathematics. Rather, we as a society should value the areas in which girls excel as much as we value those in which boys excel.

Teachers who took this role worked actively to teach children to value many different types of skills and interests; several told me that pushing children into activities in which they were not interested, merely to make girls and boys more similar to one another, was not fair. They thought it was better to respect differences and let children develop their own interests. They did not think that girls and boys had to be alike; rather, they thought that girls' and boys' activities should be equally valued by society.

I did not expect people to argue against treating boys and girls equally

When I discuss the respect-differences role with others, many people tell me that it is too idealistic. Although society's views are changing, the possibility that childcare workers will earn the same salaries as engineers by the time our students enter the labor force is unlikely. Furthermore, a knowledge of mathematics empowers people in our technological society even if people choose a career in which they do not use much mathematics. We should want girls to be empowered and to be able to support themselves as adults. People who find this role idealistic doubt that changes will occur fast enough for today's girls to thrive without mathematics backgrounds.

Role 2: Ensure that girls and boys have the same experiences

A second way that teachers described their roles in addressing gender equity is to treat girls and boys equally. Teachers who played this role did whatever they could to ensure that girls and boys had the same experiences in mathematics class. Teachers noted that they cycled through index cards to make sure that they called on all children the same number of times, included equal numbers of male and female names in their mathematics story problems, and rotated children through different assigned roles during small-group work to ensure that gender did not influence a child's experience in their classes. These teachers did not offer choices for mathematics activities: all children were required to participate in solving puzzles or playing mathematics games.

These teachers believed that they had to monitor their behaviors to ensure that they treated girls and boys equally. They believed that if they did not consciously do so, they might inadvertently call on boys more often than girls or praise girls for being neat and praise boys for being smart. In addition to monitoring their behaviors, many of these teachers also monitored their beliefs to ensure that they did not hold different ideas about girls and boys. A first-grade teacher said, "I think a teacher could treat boys and girls differently and not be aware of it.... It's hard not to do those things, especially if you've been culturally encapsulated with it."

When I began to discuss this role with others, I did not expect people to argue against treating girls and boys equally; however, some people do find this role problematic. The difficulty lies in the fact that research shows that girls and boys have fairly similar experiences in school (Koehler 1990) but that males still vastly outnumber females in mathematics-related careers. Girls and boys quickly learn what is and is not perceived to be appropriate for

their genders. Some people argue that teachers have to do more than treat girls and boys equally for females to overcome the negative influences of society.

Role 3: Attempt to compensate for gender differences in society

The third role that teachers assume in addressing gender equity is to treat girls and boys differently in an attempt to compensate for gender inequities in society. Teachers who embraced this role made conscious efforts to promote girls' interest in mathematics and related activities. A first-grade teacher who took this role told me this:

I want girls to succeed because I'm so mad that I didn't get the opportunity. I would like them to be equal in what they can do and to really leave my class feeling strong; feeling like they have a voice...I do like to call on girls more during math, promote them more, because I think boys tend to have an advantage in math and science because of our society. So I tend to push the girls, maybe, a little harder.

These teachers told me that they spent time throughout the curriculum discussing gender stereotypes and the fact that gender need not influence a person's interests or career options. They specifically chose books with characters whose personalities, pastimes, or occupations did not match gender norms. When they saw that children segregated themselves by gender, these teachers often intervened and encouraged children to mix, especially when children were engaged in activities that were typically associated with their genders.

These teachers gave special attention to both boys and girls. They worked to help boys overcome the negative attitudes of society toward areas in which males typically do not excel. For example, teachers worked to help boys learn to cooperate with others, be nurturing, and engage in activities that are often viewed as stereotypically female. A fifth-grade teacher commented about the special attention.

I would prefer that my boys were more cooperative, and not so aggressive and so argumentative, because they close their ears to listening to other opinions. When the children are working in small groups, it's the boys that are having the hard time because their minds are closed. They're thinking, "My way is right." So I want to open up the boys' channels of other possibilities of thinking. Help them see that when they insist that they're right, sometimes they fail because they've done it, and they didn't listen to other people's ideas to see what other people did. They will be better off in this world if they can listen and learn from others.

As with all the roles, when I began discussing this perspective with teachers, some found it problematic. Some people view differential

treatment as inherently unfair, believing that giving girls special attention in mathematics is unfair to boys. These people probably think that giving special attention to boys in areas in which girls typically excel is also unfair. One teacher who chose not to take this role said, "You just can't give more attention to the girls. Even if the boys are always better in math, I don't think you can ignore the boys if they come in stronger. I think you need to be equal." Another teacher who disagreed with this attempt to compensate for gender differences said, "I sure wouldn't hold the boys back to catch the girls up.... I would not expect the girls to catch up, because that's not fair."

Addressing the Problem

I have described three different roles that teachers play in addressing the issue of gender equity in mathematics instruction. As is true of most complex problems, this one has no one best solution. Each of these roles has its benefits and problems. Even if we assume that the ultimate goal is to eliminate gender differences in mathematics achievement and participation, research on gender equity in mathematics does not tell us which of these roles would accomplish this goal most efficiently. Nor does research tell us whether greater participation in mathematics will benefit all women. Many females may lead perfectly fulfilling lives without participating in mathematics (see Noddings [1998] for a discussion of this view). As with all interesting problems, the push toward gender equity presents many new questions in the quest for solutions.

None of the teachers I interviewed were completely consistent in adopting any one of these three roles. I have also discussed these perspectives with teachers informally and continue to find that teachers are inconsistent in their belief systems. I see this inconsistency as a good sign because it shows that these teachers, like all good problem solvers, are thinking about the specific aspects of a situation before they decide on a strategy. For example, one teacher used index cards to make sure that she called on all children equally and did not think that giving more attention to girls during mathematics instruction was fair. This same teacher went out of her way to choose literature for her class that featured characters who defied typical gender stereotypes. Another

We need to use our best problem-solving strategies to work toward gender equity

Activity sheet on gender equity in mathematics education

Read each of the following statements. Using a scale from 1 to 4, decide how strongly you agree or disagree with each statement. The issues raised by these statements have no right or wrong answers, but you should think about why you agree or disagree with the statements.

Statements	Agree	2	3	Disagree
1. The best way for a teacher to address gender equity in mathematics is to be gender blind. I never let a child's gender influence how I interact with the child.	1	2	3	4
2. I know many adult women who are perfectly happy and use little if any mathematics in their daily lives. I notice that many of my female students are not terribly interested in mathematics. I know that some people would say that I should work to increase their interest, but I think these girls are fine just the way they are. I want to encourage them in the areas to which they are naturally drawn and not try to push them into something that does not interest them.	1	2	3	4
3. I want to be as equal as possible when I interact with children during mathematics instruction. I have to focus on gender to make sure that it does not influence how I interact with children. I do not want to praise girls for paying attention and praise boys for clever solutions. If I do not think about gender, I am afraid that I will fall into stereotypic interactions with children.	1	2	3	4
4. The girls in my class are already uninterested in mathematics. I understand perfectly well how they come up with these notions. In the adult world they know and the television shows they watch, many more men than women are involved in mathematics-related careers. I have no choice but to work harder with the girls to develop their interest and confidence in mathematics. This approach is the only fair one that I can take.	1	2	3	4
5. As much as I hate to admit it, boys and girls are different. I buy dolls for my son and trucks for my daughter, but those toys just collect dust. The situation is the same with the children I teach. Although some children are exceptions to the rule, I find that more boys than girls excel in mathematics. Nothing I can do will change that reality.	1	2	3	4
6. I listen carefully to how the girls in my class talk about themselves as learners of mathematics, and if I note beliefs that could get in the way of success, I do what I can to encourage more positive beliefs. Of course, I listen to boys, too; but seldom do I have to work to change boys' beliefs in the same way that I do girls'. When the issue is cooperating with others, the tables are turned. I work far harder to teach boys to cooperate than I do girls.	1	2	3	4

teacher said that she did all she could to encourage girls to persist in mathematics. She also put in extra effort to educate parents about the importance of mathematics for their daughters. This same teacher, however, also emphasized in her class the value of the many different gifts that we all give to society. She wanted her students to feel good about the strengths that they had, not to tie their self-esteem to how well they did in mathematics.

After examining teachers' beliefs, I am more convinced than ever that we need to use our best problem-solving strategies to work toward gender equity. We must define the problem, reflect on the decisions that we make, and examine the influence of these decisions on the children in our classes. We must work with others, especially others with whom we do not totally agree. I have learned a great deal about my own beliefs by discussing these be-

liefs with others. With the advantages of this exchange in mind, I offer the following action research ideas.

Action Research Ideas

Find a small group of educators, three to five teachers with whom you usually interact, and organize a meeting to discuss gender and mathematics. At the start, have each participant spend twenty minutes writing a response to the following: "What are the ways in which I address gender equity in my mathematics instruction?" Describe the three different roles presented in this article, or let the participants read the article and decide whether some of the approaches that they described in their writing fit into one of these roles. Discuss your findings among your group. Is the group consistent in its beliefs? Are individuals consistent? Remember that the goal of this discussion is not to reach consensus but to increase awareness so as to help participants become better problem solvers when they address gender equity in mathematics.

Organize a meeting of twenty to thirty people to address gender equity. Give participants the activity sheet in **figure 1**, and ask them to work on it individually for ten to fifteen minutes. Then have them form small groups to discuss their ratings. Emphasize that the goal of the discussion is not to reach consensus but, again, to increase awareness to help participants address this issue. Have each group list important points raised in the discussion and issues about which the group members had divergent opinions. At the end of forty-five minutes or so, have the groups share their lists with the whole group. What similarities do you find among groups? If you wish, distribute this article to participants as a follow-up to the meeting.

Bibliography

- Fennema, Elizabeth, Thomas P. Carpenter, Victoria R. Jacobs, Megan L. Franke, and Linda W. Levi. "A Longitudinal Study of Gender Difference in Young Children's Mathematical Thinking." *Educational Researcher* 27 (June–July 1998): 6–11.
- Kimball, Meredith M. "A New Perspective on Women's Math Achievement." *Psychological Bulletin* 105 (March–April 1989): 198–214.
- Koehler, Mary S. "Classrooms, Teachers and Gender Differences in Mathematics." In *Mathematics and Gender*, edited by Elizabeth Fennema and Gilah Leder, pp. 128–48. New York: Teachers College Press, 1990.
- Leder, Gilah C. "Gender Differences in Mathematics: An Overview." In *Mathematics and Gender*, edited by Elizabeth Fennema and Gilah Leder, pp. 10–26. New York: Teachers College Press, 1990.

Levi, Linda. "Teachers Beliefs about Gender Equity and Mathematics." Paper presented at the annual meeting of the American Education Research Association. San Francisco, Calif., 1995.

Meyer, Margaret R., and Mary S. Koehler. "International Influences on Gender Differences in Mathematics." In *Mathematics and Gender*, edited by Elizabeth Fennema and Gilah Leder, pp. 60–95. New York: Teachers College Press, 1990.

National Science Board. *Science and Engineering Indicators—1998*. Arlington, Va.: National Science Foundation, 1998. NSB 98-1.

Noddings, Nel. "Perspectives from a Feminist Philosophy." *Educational Researcher* 27 (June–July 1998): 17–19.

The Editorial Panel encourages you to share your reaction to this article. Engage in the action research ideas suggested, and share the results and your reflections with a short double-spaced letter for possible publication in "Readers' Exchange." The Panel also welcomes manuscripts on the topic of gender equity in mathematics. Or consider sharing your viewpoint by submitting a manuscript for review in "In My Opinion." Such manuscripts should be limited to approximately six hundred words.

**Reprinted with permission from
Mathematics Teaching in the Middle
School, copyright 2000 by the National
Council of Teachers of Mathematics**