Teachers' Instructional Decision-Making: Is it Gender-Biased?

Martha M. Voyles[1], Tim Fossum[2], and Susan Haller[2]
[1]*Grinnell College, Grinnell, IA, USA*
[2]*State University of New York, Potsdam, NY, USA*
voylesm@grinnell.edu

Abstract

This study examines teacher interactions with boys and girls in single-gender technology classes. We analyzed transcripts of videotapes of instruction, interviews with the teachers and students, student questionnaires, and final robot programs. Girls and boys differed in a number of ways, and teachers explained their differing interactions with boys and girls as responses purposely designed to address those differences. This finding is an important consideration as we strive to design instruction that promotes the learning of girls and boys equally, but we should not let it be an argument for the status quo. (This paper is a summary of Voyles, Fossum, & Haller, 2008)

Most teachers in today's schools are aware of the cultural gender roles that are taught to children well before they enter school and that can limit students' options as they become adults. The research from public school classrooms shows how teachers may unintentionally contribute to the perpetuation of gender stereotypes especially during instruction in STEM (Science, Technology, Engineering, and Math) areas.

As early as 1973, Good, Sikes, and Brophy (1973) reported that boys dominated their elementary classrooms in a number of ways, and subsequently similar findings have been reported for all grade levels. For example, teachers have been found to call on boys more often, accept more call outs from boys, give boys more praise and more criticism, ask boys more higher-level questions, and more often ask boys to expand on a response (Drudy & Chathain, 2002; Einarsson & Granstrom, 2002; Guzetti & Williams, 1996; Martin & Newcomer, 2002). Female and male teachers are equally likely to show gender bias (Martin & Newcomer, 2002; Sadker & Sadker, 1994). In 2000, despite a growing awareness of gender stereotyping, the American Association of University Women (AAUW) reported that classroom bias was a factor in girls' decisions to pursue STEM-related coursework and careers. What little is known about instruction with students working in small groups shows similar instructional bias (Forgaz & Leder, 1996).

Two computer scientists (Tim Fossum and Susan Haller), who were aware of gender bias and concerned about the large underrepresentation of girls in computer science, decided that they would offer a summer robotics course in single-gender sections so that girls would not be competing for attention with boys. They also wanted to compare the two sections. With an educational researcher (Martha Voyles), they developed two research questions:

1) In a single-gender robotics course, do boys and girls differ with respect to enrollment, interest, prior experience, achievement and self-confidence, cooperation, and requesting help?
2) Do teachers differ in the way they interact with boys and girls who are working in same-gender triads in a robotics course?

Method

Course description. During each of two summers we taught 2-week-long, single-gender sessions of a robotics course for rising fourth-, fifth-, and sixth-grade students. Students spent 3 hours each day working in assigned groups of 3 sharing a robotics kit and a computer. The instructional materials were adapted from the curriculum developed by the Center for Engineering Education Outreach at Tufts University and used a discovery approach. After building their Lego robots using typical Lego pictorial instructions and learning some basic commands used by the Robolab program, students were given challenges that required the group to engineer various moving features for their robots and then program their robot to use the features. For example, the group with a robotic house had to design a door that would play music and open automatically when the doorbell was pressed. Each challenge had many possible solutions. Four instructors provided assistance but did not provide solutions.

Data collection. In each of the four sessions, two student groups were randomly selected to be videotaped, and the videotapes were then transcribed. We interviewed individually the students in those two groups, plus an additional non-videotaped group, at the beginning, middle, and end of each session. We also interviewed the 4 teachers every day. All of the students completed a daily, three-item questionnaire about their interest, course difficulty, and group cooperation, and we selected the best final robot program from each group to use as a measure of achievement.

Data analysis. We coded all the student-teacher interactions using three codes: 1) initiated by student or teacher, 2) type of task students were working on (building, programming, or engineering), and 3) function of the talk (social, procedural, feedback, promoting cooperation, or instructional). The instructional category was then further subdivided into seven categories: 1) low level exchanges, 2) high level exchanges, 3) doing things for students, 4) thinking for students, 5) explanation, 6) summarizing, and 7) checking for understanding. Each interaction was coded with all the applicable codes. Using grounded theory, the student and teacher interviews were analyzed for common themes across interviews. A grading rubric was developed for the students' final programs.

Findings

Our first research question was whether there would be gender differences among the students. The most pronounced difference was in initial interest. In the first year only 3 girls enrolled for the class whereas 28 boys tried to enroll. We had to actively recruit 15 girls and turn away 10 boys. The same thing happened the second year. The authors chose to work with students entering fourth, fifth, and sixth grades because other researchers (AAUW, 2000) have reported that girls' interest in technology declines in middle school. Our study demonstrates that when it was a matter of selecting courses, gender preferences are obvious even with fourth- to sixth-grade girls. However, it was not difficult to recruit girls, and in their initial interviews before they knew much about what they would be doing, the girls claimed to be interested in computers and in construction activities and did not express a preference for art or craft activities. The boys did report much more experience with Legos, and this was evident in their initial building of robots from a set of directions. However, their greater experience with Legos did not make them any better than the girls when it came to designing moving parts. Even though the project compared recruited girls with volunteer boys, we found no differences in interest or enjoyment of the course in the interviews and no significant differences in daily ratings of interest or course difficulty, although the girls' ratings were slightly more favorable. There were also no differences in achievement in the final programs they wrote.

Girls did initiate more interactions with teachers than did boys, and this applied to most categories of talk. Because some of the questions girls asked were ones to which they already knew the answers, such as asking if they should clean up at the end of the day or use a slow motor speed as per instructions, many of the questions seemed designed to develop a relationship with the teachers and show themselves to be good students rather than to get information. Neither an examination of the transcripts nor the teacher interviews indicated that the girls actually needed more assistance except with the initial building task. In addition, girls were somewhat more cooperative with the instructors. Similar numbers of boys and girls expressed a preference for group or individual work, but the coding of the videotapes, students daily ratings of their group work, and teacher interviews indicated that the girls were somewhat more cooperative with their peers. Looking at the data by group shows that it is a subset of boys that are responsible for most of the difference.

Our second research question was whether teachers' interactions with students differed by gender. We did find significant differences, and those differences largely corresponded to gender differences. Table 1 shows the student gender differences and the corresponding teacher behaviors. Across all types of interaction, teachers initiated many more interactions with boys than with girls. In their interviews, the teachers spontaneously talked about this, saying they did it on purpose because in their opinion the boys were less likely to initiate interactions with teachers even when they were floundering. Because Fennema and Peterson (1985) have suggested that boys' greater achievement in STEM areas might be due to greater perseverance, we asked the teachers if they thought the girls were too dependent and quick to ask for help. The teachers responded with an emphatic "no." They explained that they could trust girls to ask for help when they needed it, but boys glossed over problems, ignored contradictory results, and even blamed faulty robot behavior on mechanical or computer error rather than programming mistakes. In terms of explicitly instructional talk including higher- and lower-level questions and the strategies teachers used to assist students, the only difference was that teachers were somewhat more likely to think for, or do things for, girls. Much of that teacher behavior, however, was provided during the initial robot building where girls were much less familiar with Lego directions and during the first girl session when teachers were unfamiliar with the curriculum and anxious that the recruited girls have a positive experience. Still, this is an area of concern.

Conclusion

One could interpret the results of our research to mean that teachers do not display gender bias, and that what appears to be bias in some prior research is simply teacher responsiveness to gendered behaviors that students have learned in the wider culture and bring to the classroom. We do think it is critical in doing workshops about gender bias with teachers to acknowledge that they do have instructional reasons for their behavior and that students come into their classes with gender differences that must be addressed. Nonetheless, we think that rather than reinforcing gender differences, schooling should help students identify and challenge behavioral mores that tell girls and boys what they should be interested in and how they should behave.

One could also interpret our results as providing a rationale for single-gender classes in STEM areas. From our data an argument could be made that since the literature generally reports that boys receive more of their teachers' attention than girls, and our research shows that when there is no competition with boys, girls engage in more teacher interactions than boys, coeducational classes may be doubly detrimental for girls. However, we would argue that a better approach would be to use this research to design better coeducation. One reason is that although we did find evidence for masculine and feminine learning styles, individuals displayed them to a greater or

lesser extent, and they were not perfectly coincident with gender. For example, the highest achieving boy group had more interactions with teachers over programming than any other boy or girl group. Another reason is that we found no differences in the actual instructional questioning teachers used with boys and girls. Additional research may be able to tell us if, for example, there is an optimum amount of teacher-student interaction or an optimum amount of cooperative work. In the meantime, we think that both styles have limitations, sometimes where the other has strengths, and that with knowledge about gender differences, teachers could design instruction that would help students stretch themselves to develop the flexibility to learn and function in a variety of instructional environments.

Table 1
Characteristics of Feminine/Masculine Style and Corresponding Teacher Behaviors

Style	Teacher behavior
Feminine	
Less inclined to enroll in a technology course	More encouragement and assurance of correctness
Lack of experience in male domain activities	More inclined to do and think for girls
More likely to initiate interaction with teachers	Fewer teacher initiated interactions
Somewhat more cooperative with peers	Fewer interactions about cooperation
More attention to directions	Fewer corrective interactions
More social, more responsive to teachers, use talk to develop relationship with teacher	More social interactions with girls
Masculine	
More inclined to enroll in a technology course	Less encouragement and assurance of correctness
Experience with male domain activities	Fewer teacher-student interactions during building and technical tasks
Less likely to initiate interaction with teachers	More teacher-initiated interactions
Somewhat less cooperative with peers	More interactions about cooperation
Less attention to directions	More corrective interactions
Less social	Fewer social interactions

By far the largest student difference was in the enrollment pattern. Given this large difference, we expected to find accompanying differences in attitudes toward computers and toward building and engineering robots. However, that was not the case. It seems that girls behave in gender-stereotypic ways even before they have developed the attitudes that go with such behavior. Even though they were recruited for the course, they enjoyed it as much, if not more, than the boys, and they were equally good at it. The fact that fourth- through sixth-grade girls do not differ from boys in their attitudes toward technology argues strongly for providing them with experiences in these areas so that whatever attitudes they develop will be based on personal experience rather than on gender stereotypes. This might well result in more girls discovering technology interests and could eventually address the large gender imbalance in computer science and engineering, but even if that did not happen, girls would at least be making their own decisions about their interests rather than simply accepting society's ideas about what girls like or should do.

References

American Association of University Women (AAUW). (2000). *Tech-savvy: Educating girls in the new computer age*. Washington, DC: Author.

Drudy, S., & Chathain, M. (2002). Gender effects in classroom interaction: Data collection, self-analysis and reflection. *Evaluation and Research in Education*, *16*, 34-50.

Einarsson, C., & Granstrom, K. (2002). Gender-biased interaction in the classroom: The influence of gender and age in the relationship between teacher and pupil. *Scandinavian Journal of Educational Research*, *46*, 117-127.
Fennema, E., & Peterson, P. L. (1985). Autonomous learning behavior: A possible explanation of gender-related differences in mathematics. In L. C. Wilkinson & C. B. Marrett (Eds.), *Gender influences in classroom interaction* (pp. 17-35). Orlando, FL: Academic Press.
Forgaz, H. J., & Leder, G. C. (1996). Mathematics classrooms: Gender and affect. *Mathematics Education Research Journal*, *8*, 153-173.
Good, T. L., Sikes, J. N., & Brophy, J. E. (1973). Effects of teacher gender and student gender on classroom interaction. *Journal of Educational Psychology*, *65*, 74-87.
Guzetti, B. J., & Williams, W. O. (1996). Changing the pattern of gendered discussion: Lessons from science classrooms. *Journal of Adolescent and Adult Literacy*, *40*, 38-47.
Martin, B., & Newcomer, S. (2002). A descriptive study of gender equity in rural secondary classroom situations. *Rural Educator*, *23*, 37-46.
Sadker, M., & Sadker, D. (1994). *Failing at fairness: How America's schools cheat girls*. New York: Macmillan.
Voyles, M. M., Fossum, T., & Haller, S. (2008). Teachers respond functionally to student gender differences in a technology course. *Journal of Research in Science Teaching*, *45*, 322-345.