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# Contexts for Boys and Girls Learning Mathematics: Teacher Interactions and Student Behaviour in Two Classrooms

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Teacher interactions with boys and girls during mathematics lessons were observed for 20 days in one Form 1 class and 11 days in another Form 1 class. Teachers in both classes initiated more controlling statements to boys than girls. Teacher A (a male) directed more expository teaching to boys than girls, initiated more interactions with boys, and interacted more with boys generally. Teacher B (a female) waited for girls more, answered more girls's questions, supervised and generally responded to girls more than boys. There were very few differences between the behaviour of target boys and girls, except that girls made more non-verbal initiations towards teachers than boys in one class and girls made more nonverbal responses to teachers than boys in the other class. The level of child initiations and active response to teacher initiation was low. Both boys and girls had a relatively high level of on-task behaviour (76%) and spent about 10% of their time waiting. On average 28% of mathematics problems were incorrect but there was very little written teacher feedback and this was mainly for presentation. Children spent about half of their time listening to the teacher talk, a third doing seat work and a much smaller amount of time (6% for one class and 15% for the other) doing work with peers in a small group. It was concluded that these classrooms were not responsive social contexts for learning.

*Keywords*: Mathematics, gender, observations, feedback, initiations, classroom interactions.

Mathematical skill is highly necessary in today's society for a wide variety of important professions such as the sciences, engineering, technology and economics, yet little is known about how such skills are acquired in the classroom. Women are rarely to be found in mathematics-related professions ("New Zealand Women" 1985) and this could be related to their learning opportunities in the area.

Accurate descriptions of classroom contexts for boys and girls learning mathematics are necessary in order to identify variables which could influence subsequent learning, and help to explain gender differences in mathematics at the high school level. Techniques of observing and recording classroom mathematics lessons are also required to facilitate description and evaluation. The present study is an attempt to observe and evaluate teacher interactions with boys and girls in two mathematics classrooms.

Considerable research evidence has now accumulated comparing the mathematical skills of boys and girls. Although few studies show differences at the primary school level, a number show that a difference in favour of males generally appears at about 14 (Fennema & Sherman, 1977; Maccoby & Jacklin, 1974; Mullis, 1975; Sherman, 1980). Studies carried out in the fifties (Milton, 1958; Carey, 1958) showed a male advantage especially in word problems, and recent studies confirm that these differences still exist (Chipman, Brush & Wilson, 1985; Johnson, 1984; Kaplan & Plake, 1982; Marshall, 1984). Benbow & Stanley (1980) have studied mathematical talent among 13 year-olds and found large sex differences in favour of males who score about half a standard deviation (on standardised tests of mathematical skill) higher than females. In the highest scoring levels, boys outnumber girls by more than 2 to 1. Chipman & Thomas (1985)

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report than only 7% of students on an honor roll for outstanding performance in mathematics in the United States were girls. Of the 214 international Mathematical Olympiad contestants in 1989 8 (3.7%) were girls (D. Holton, personal communication, 1989).

These findings contrast with other studies of performance across the range of mathematical ability (e.g. Marshall, 1984) which show that the actual magnitude of score differences between boys and girls is rather small. Hyde (1981) argues that gender differences are responsible for only about 1% of the variation in quantitative ability seen in the population. Recent evidence (Garden, 1987) shows that in New Zealand at least at the fifth form level, girls perform as well as boys on mathematics examinations. Garden found no difference in 1985 School Certificate Mathematics exam scores for boys and girls, although boys outperformed girls in the sixties. D. Holton (personal communication, 1989) reports that females performed significantly better than males in mathematics at university level, although males are more likely to be found in both tails of the distribution.

Although there are many studies of the nature of mathematical performance variation in boys and girls there are very few studies focussing on how the day-to-day learning environment differs for them. It has been argued (Beckwith, 1983) that boys and girls in the same classroom have a different learning experience. According to Ramsay (1982) teachers contribute unwittingly to giving males priority in the classroom: ". . . they (teachers) consistently give preferential treatment to the boys and keep the girls on the periphery of classroom activity. Further, the boys use a variety of behaviours to ensure their unequal share and dominance of educational resources" (Ramsay, 1982, p.4).

Brophy (1986), on the other hand, argues that teachers' greater frequency of interaction with boys is a reactive response to differential student behaviour rather than a teacher effect on children. Eccles and Blumenfeld (1985) also believe that teachers play a passive role in the maintenance of sex differentiated achievement. They say that teachers consolidate existing differences rather than cause them.

A review (Meece, Parsons, Kaczala, Goff, & Futterman 1982) of sex differences in mathematics achievement cites several studies showing that teachers tend to interact with boys more than girls especially in mathematics and science classes. Leinhart, Mar Seewald, and Engel's (1979) study is particularly relevant to mathematics. They found a different pattern of teacher interactions with boys and girls depending on the subject, at the grade 2 (7 year-old) level. Teachers made more academic contacts with boys than with girls in mathematics but more academic contacts with girls in reading. Hence girls were shown to get more instructional time in reading and boys more in mathematics. Boys could receive as much as six or more hours of instruction in a year than girls. The cumulative effect of this over the years of primary education could well explain male superiority in later years.

Dweck, Davidson, Nelson, and Enna (1978) suggest that boys and girls receive different patterns of evaluative feedback for their work. They found that boys are criticised more than girls for intellectually irrelevant aspects of their work (like untidiness or bad behaviour) while girls were criticised more for the academic quality of their work (such as correctness). Dweck et al. argue that differential feedback results in differential attributions with girls being more likely to attribute their successes to luck rather than ability and their failures to lack of ability compared to boys. It is argued that classroom dynamics result in the finding that boys are more likely than girls to perceive themselves competent in mathematics (Stipek, 1984).

Eccles and Blumenfeld's (1985) comprehensive study of the classroom experiences of males and females in over 50 primary and junior schools did not replicate Dweck's et al. study. The authors found that boys were the recipients of more teacher talk than girls, but girls received disproportionately more academic performance communication and boys more communication on procedural issues. Most of the negative informatives (of which girls received more) linked academic difficulties to insufficient effort. Boys received more negative conduct feedback even though boys did not misbehave more than girls. The study did not find a relationship between differential teacher treatment and student perception. For example, despite the fact that girls received most of their attributions for academic performance, they did not rate academic success as more important than boys. Eccles and Blumenfeld argue that sex differences in achievement patterns are not necessarily the result of differential teacher communications but are related to the widely held cultural beliefs that children are exposed to in a variety of settings. The study

certainly illustrates the considerable complexity of the interactions that take place in classrooms and the less than simple and direct relationship between classroom interactions and student characteristics.

Eccles and Blumenfeld (1985) also analysed differences in teacher behaviour in the 5 classrooms with the largest and smallest sex differences in students' expectations for themselves. In the most sex-differentiated classrooms, teachers tended to be more critical and use a public rather than a private teaching style, for example they used sarcasm and relied on student volunteers for answers to questions. In the least sex-differentiated classrooms, teachers tended to have more private interactions with students, using more conference-like interactions and asking specific individuals for answers rather than calling for volunteers. The authors conclude that boys tend to thrive more than girls in a competitive environment and that girls develop more positive attitudes when given more personal attention.

Stallings (1985) examined influences on women's decisions to take advanced mathematics course in 11 secondary schools. In mathematics classes male students were spoken to more often, asked more questions, and given more individual instruction than female students. Although women volunteered answers as often as men, men were more likely to be called on to respond. Stallings found that parental encouragement and support, successful experience in maths classes, career plans and spatial ability were all important influences on decisions to enrol in advanced mathematics courses.

Irvine (1986) observed teacher/student interactions in 63 classrooms from kindergarten to grade 5, mostly in language arts, but also in other subject areas including mathematics. Boys initiated more positive and negative interactions with teachers than girls. Girls received less academic and non-academic feedback than boys. In general boys received more negative feedback from teachers than girls.

According to Meece et al. (1982), ". . . additional research is clearly needed to determine how classroom experiences might undermine girls' math achievement expectations and performances" (p330).

The present study examines whether the classroom learning context for boys and girls in mathematics lessons differs. The study asked whether the amount and nature of teacher interaction with girls differed from interactions with boys, and whether boys and girls elicited different interactions from teachers. In particular, the study sought to compare opportunities for boys and girls to initiate interactions or learning sequences during mathematics.

Opportunity to initiate has been argued as one of several important characteristics of contexts which promote independent learning (Glynn, 1985; Glynn, 1987). Where teachers retain total control over initiations within a lesson, not only are there few opportunities for children to initiate, but also important interactive and social characteristics of learning may be lost.

Previous studies (eg Leinhart et al., 1979; Irvine, 1986) have tended to sample behaviour across many classrooms and observe for a brief period of time, but the present study focussed on two classrooms and observed for a much greater length of time. Form I classrooms were chosen because several studies show that sex differences in maths achievement do not appear until about 14 years (Fennema & Sherman, 1977; Maccoby & Jacklin, 1974; Mullis, 1975; Sherman, 1980). If classroom mathematics contexts at intermediate school differ for boys and girls, then such differences could influence the subsequent development of attitudes and achievement in mathematics at the high school level.

## Method

*Subjects*

Twelve target children including 3 girls and 3 boys from each of two intermediate school Form 1 classes (for 11 to 13 year-olds) were selected. The school serves a community with diverse backgrounds, from working class to professional. A boy and a girl were randomly selected from the categories "above average", "average" and "below average" in mathematics in each class. Teachers classified children on their lists into above average, average, and below average on the basis of their records of each child's progress in mathematics. One class had 31 children and a male teacher (referred to as Class A and Teacher A) and the other class had 30 children and a female teacher (referred to as Class B and Teacher B). The attendance records during the observations showed that 15 boys and 13 girls were present on average in Class A and 12 boys and 15 girls on average for Class B.

*Procedure*

*Observation Instrument.* Approximately 10 days of pilot observations were carried out to develop a reliable observational schedule for gathering data on teacher/pupil interactions in mathematics. Pilot observations were carried out in a different classroom from those observed for data collection. A videotape of one

maths lesson was used to train the two observers and to clarify the definitions of categories of behaviour. The categories were partly based on Clay's (1985) procedure for observing oral language interactions, but modified for on-the-spot coding with older children in the context of the intermediate classroom.

Observations were carried out in mathematics lessons during the second term of 1987. Each class was observed by one of the research assistants during the first hour of the day when mathematics was scheduled. One observer was a postgraduate student in psychology and the other was a graduate in education working as a full-time research assistant. Both had considerable experience with observational procedures.

Observers located themselves as unobtrusively as possible at the back of the classroom. Maths lessons were observed for 20 days in Class A and for 11 days in Class B. The observations were on consecutive days as far as possible, though there were various interruptions because of sickness, absence, or disruptions to normal classroom schedules. It had been intended that both classrooms would be observed for a similar length of time, but the observers had more difficulty in gaining access to Class B because of schedule disruptions (for class trips for example) when the teacher preferred the observers not to be present. The study had to be terminated at the end of term for both classes, both because of teacher preference and observer availability.

For each maths lesson a combined interval/event sample recording was carried out. The observer, using a battery operated signalling device, watched the teacher (or child) during a 10 second observe interval, and during a 5 second record interval she wrote down an abbreviation representing any behaviour that was observed. The six target children were observed in random order for 45 seconds each (total time 4½ minutes) followed by the teacher being observed for 5 minutes. This sequence was repeated for each lesson until a total of 15 minutes of teacher observation and 18 minutes of child observations (3 minutes per child per lesson) was obtained. For Teacher A (the male teacher) a total of 5 hours of observations were carried out, while for teacher B (the female teacher) 2 hours and 45 minutes of observations were carried out. Target children in class A were observed for one hour in total, while target children in class B were observed for a total of 33 minutes.

*Observational Measures.* There were four main categories of teacher behaviour coded per interval: Teacher initiations, children interacted with (boys or girls), teacher responses, and setting. Teacher initiations were any teacher comments that required a pupil to respond, or began an interaction sequence. These initiations could be focussed on control of children's classroom behaviour (control), presenting lesson material or demonstrating a mathematics example (expository) or seeking answers or comments from children (soliciting). Teacher responses were either positive or negative responses to academic or non-academic behaviour, accepting children's ideas or suggestions, answering a question or supervisory. The settings were either whole class instruction, group instruction, seatwork or transitional. There were four main categories of child behaviour coded per interval: child initiations (verbal or non-verbal), on or off-task behaviour, child responses (verbal, non-verbal or waiting), and setting (as for teacher behaviour).

*Permanent Product Measures.* In each of the lessons observed, all written work attempted and completed by each target student was also examined by the observer. The observer recorded: the number of items attempted by each student, the number of items completed correctly by each student, and any written feedback provided for this work by the teacher. By examining the books for the whole class it was possible to find out who had completed the maximum amount of work in the class. Target children's number of items completed compared to the maximum number in the class completed, was calculated as a percentage for each lesson observed. Also the percentage of items correct was calculated.

*Reliability. Reliability* checks of observations were made on three separate occasions during the study. Observers simultaneously recorded behaviour of teachers and children. The percentage of agreement for child behaviour was 91%, 93%, and 99% with an average agreement of 94%. The percentage for teacher behaviour was 79%, 82% and 95% with an average agreement of 85%.

## Results

The total frequency of interactions in each category of teacher behaviour were analysed using chi-square to assess the distribution of teacher interactions between boys and girls. The expected frequency of interactions was calculated according to the number of boys and girls present. For example in Class A there were 15 boys and 13 girls so 53.6% of any category of teacher interaction for that class would be expected to be with a boy.

The percentage of intervals when boys and girls were involved in verbal and nonverbal initiations, on task, verbal and nonverbal responses, extended verbal, and waiting were compared for boys and girls in each class using the Mann Whitney U test. The percentage of problems attempted and correct were also compared using the Mann Whitney U test. Comparisons of behaviour in class A and class B were also carried out using the same test.

### *Teacher Behaviours*

Table 1 shows that Teacher A directed more control statements to boys than to girls, $\chi^2(1) =$

Table 1. *Teacher Behaviour*

| | Class A (20 lessons) | | | Class B (11 lessons) | | |
|---|---|---|---|---|---|---|
| | Boys ($n$=15) | Girls ($n$=13) | Chi square | Boys ($n$=12) | Girls ($n$=15) | Chi square |
| Teacher Initiations | | | | | | |
| Control | 54 | 28 | 4.63* | 26 | 15 | 6.27** |
| Expository | 101 | 56 | 6.74** | 30 | 37 | 0.16 |
| Soliciting | 206 | 151 | 1.91 | 31 | 40 | .004 |
| Total | 361 | 235 | 10.35** | 87 | 92 | 1.84 |
| Children Interacted with Teacher Responses | 605 | 398 | 18.44** | 135 | 193 | 1.07 |
| +ve Resp Academic | 34 | 27 | 0.06 | 4 | 7 | .27 |
| -ve Resp Academic | 4 | 4 | - | 0 | 0 | 0 |
| +ve Resp Non-Acad | 3 | 3 | - | 0 | 0 | - |
| -ve Resp Non-Acad | | | | 0 | 1 | - |
| Accepting ideas | 80 | 91 | 3.59 | 21 | 26 | .009 |
| Waiting | 12 | 16 | 1.40 | 5 | 17 | 4.04* |
| Verbal R | 110 | 72 | 3.13 | 8 | 39 | 13.88** |
| Supervisory | 6 | 9 | 1.19 | 4 | 0 | 5.09* |
| Total R's | 249 | 222 | .24 | 42 | 90 | 9.66** |
| Sustained interactions | 75 | 47 | 2.74 | 70 | 104 | 1.00 |

*p<.05 **p<.01

4.63, $p < .05$, more expository statements to boys than to girls, $\chi^2$ (1) = 6.74, $p <$. 01, more total initiations to boys than to girls, $\chi^2$ (1) = 10.34, $p < .01$ and interacted more with boys than girls, $\chi^2$ (1) = 18.44, $p < .01$.

There were no significant differences in soliciting behaviours, positive or negative responses to academic or non-academic behaviours, verbal responses, waiting or supervisory behaviour towards boys and girls. Although Teacher A made more positive responses to boys' academic behaviour, answered more boys' questions and accepted more girls' ideas, these differences were not statistically significant.

Table 1 shows that Teacher B also directed more control statements to boys than to girls, $\chi^2$ (1) = 6.27, $p < .05$ and supervised boys more than girls, $\chi^2$ (1) = 5.09, $p < .05$. However she waited for girls more than boys, $\chi^2$ (1) = 4.04, $p <$ .05, answered girls' questions more than boys' questions, $\chi^2$ (1) = 13.88, $p < .01$ and made more responses in total towards girls than boys, $\chi^2$(1) = 9.66, $p < .01$.

Table 2. *Mean % Interval when Behaviours Occurred for Gender and Class*

| | Gender | | Class | |
|---|---|---|---|---|
| | Girls $n$=6 | Boys $n$=6 | A $n$=6 | B $n$=6 |
| Nonverbal initiations | 2 | 1 | 3 | 1 |
| Verbal initiations | 1 | 1 | 1 | 1 |
| On task | 77 | 76 | 75 | 78 |
| Nonverbal responses | 2 | 1 | 1 | 1 |
| Verbal responses | 2 | 1 | 1 | 2 |
| Extended verbal responses | 0 | 0 | 0 | 0 |
| Waiting | 10 | 9 | 9 | 10 |

Table 2 presents mean percentages (of intervals observed) of different categories of children's behaviour for gender and class. The percentages of each category of behaviour for boys and girls, and for class A and class B were compared using the Mann Whitney U test. No value of U comparing boys' and girls' scores was significant. There were also no significant differences using the Mann Whitney test between class A and class B on any category of behaviour. When the data for each class was analysed separately two significant differences were revealed. Girls made more nonverbal initiations than boys ($U = 0$, $p < .05$) in class A and girls made more nonverbal responses than boys ($U = 0$, $p < .05$) in class B.

The most striking feature of these observational data is the extremely low rates of child/teacher interactions. For example in class A each of the three boys were observed initiating a verbal interaction with a teacher for a total of 30 seconds ( 2 x 15 second intervals) during an hour of observation. Making a verbal initiation in Class A towards a teacher occurred during less than four intervals for boys and girls (about 1 minute out of one hour). The children in class B showed a similarly low level of interaction with teachers. In both classes there was a relatively large amount of time (about 10%) spent by children waiting.

Table 3. *Mean %* of Problems Attempted and Problems Correct for Gender and Class*

| | Gender | | Class | |
|---|---|---|---|---|
| | Girls $n$=6 | Boys $n$=6 | A $n$=6 | B $n$=6 |
| % Problems Attempted | 55 | 65 | 66 | 54 |
| % Problems Correct | 68 | 77 | 76 | 69 |

*Problem attempted as a percentage of the number completed by the child in the class who did the most problems.

Table 4. *Contexts of Mathematics Lessons *Mean Percentage of Intervals in Activities in Each Class*

| | Class A | | Class B | |
|---|---|---|---|---|
| | % | SD | % | SD |
| Class Instruction | 51 | 14 | 45 | 23 |
| Group Instruction | 6 | 11 | 15 | 18 |
| Seatwork | 38 | 17 | 36 | 29 |
| Transitional | 1 | 2 | 3 | 3 |
| Computer Work | 0 | 1 | 0 | 0 |
| Other Activity | 4 | 6 | 3 | 10 |

*These data come from classroom observations of target children

All of the boys and girls observed showed a very high level of on-task behaviour with an overall mean of 76%. High on task behaviour, but low initiation levels suggests that children were engaged in complying with teacher instruction and directions.

Table 3 presents the permanent product data. Mann Whitney U tests showed no significant difference between the problems completed and problems correct for boys and girls. The direction of the differences was that girls did fewer problems than boys and got fewer problems correct. There were only two written comments provided by Teacher A on target children's work. Both comments were for girls' work and were comments on presentation — "good neat work" and "good start". Teacher B used a rubber stamped "super" four times (twice for one boy and once each for different girls). She used a rubber stamped "big effort", once each for two girls and twice for one boy. "Smiley face" stamps were used four times (twice doubled —once for a boy and once for a girl). Three of the four smiley face stamps were for girls" work. There were only two written comments, both for boys — "good boy, A." and "rule up, please use ruler". In total boys had stamps 7 times and girls 5 times in Class B. These data suggest a low rate of written feedback occurred in both classes, and that such feedback was usually contingent on presentation and accuracy.

Table 4 shows that teachers in both classrooms spent most of their time (51% and 45%) engaged in classroom instruction, that is teaching to the whole class. The next most common activity was seat work which occurred in both classrooms just over a third of the time. Classroom B had more small group activity (15%) compared with Classroom A (6%).

## Discussion

The findings of the study lend modest support to the proposition that boys and girls have a different experience in mathematics lessons. Teachers directed more control comments at boys but this was the only finding replicated in both classrooms. More control was probably directed at boys because teachers felt that boys' behaviour needed more discipline and direction than that of girls. The finding supports several other studies showing that boys receive more managerial or discipline-oriented interactions than girls (e.g. Dweck, et al., 1978; Eccles & Blumenfeld, 1985). There was no evidence, however, to support Dweck et al.'s finding that girls receive more criticism for their academic work and boys more for non-academic aspects of it. Indeed little criticism was observed and teachers directed the same amount of it to boys and girls.

From the observations in only one class (with the male teacher) was there support for the view expressed by Ramsay (1982) that boys have an unequal share of teacher attention directed at them. Perhaps the current climate directed at minimising sex stereotyping in the classroom has reduced differential treatment of boys and girls. Indeed boys received slightly more attention in one class and girls in the other.

Although the magnitude of the difference in teacher attention was not great in class A, the cumulative effect of such differential interaction could be considerable. For example teacher A was observed for 5 hours and was interacting with boys in 605 intervals (about 40 per boy) and in 398 intervals with girls (about 30 per girl). If these data were extrapolated to fill the approximately 200 days of the school year, boys would receive 33.3 hours of teacher interactions and girls would receive 25 hours.

Teacher initiations in class A were more likely to be directed at boys, yet boys were not responded to significantly more by this teacher.

The possible explanation that the teacher initiated more interaction with the boys because they made more demands for attention does not receive much support from the child data since target boys in class A made fewer nonverbal initiations (usually hands up) than target girls. In general, however, there is very little evidence of any difference in the behaviour of target boys and girls for most categories of behaviour. The sample size, however, only allowed an analysis of the behaviour of a few boys and girls in each class and did not indicate how the whole class behaved. The proposition that teachers merely sustain existing differences (Brophy, 1986; Eccles & Blumenfeld, 1985) was not therefore properly tested.

The teacher in classroom B made many more responses (especially verbal responses) to girls than to boys and target girls in the class responded more nonverbally to the teacher. It is possible that teachers are more likely to interact with children of the same sex as themselves, but the observations in the two classrooms may have differed simply because of sampling variation. Further research is needed to determine whether there is a sex of teacher effect on classroom interactions with boys and girls. Other observation studies scanning a larger number of children's behaviour (including work accomplished) would be valuable to determine whether indeed boys and girls work differently during mathematics. It is also necessary to determine whether the topic and subject influences the nature of teacher interaction. For example is the classroom learning context any different during mathematics than in language? Informal observations did suggest to the observers that a more relaxed classroom learning context exists in subjects other than mathematics.

The relatively high level of on-task behaviour, similar for boys and girls, was associated with a great deal of variation amongst children in the actual amount of work accomplished and its accuracy. Considering the very great amount of time, almost half of the lesson, spent on attending to the teacher and an additional third on doing seatwork, the high on-task behaviour is even more surprising. There seemed to be little opportunity for either boys or girls to initiate learning interactions or for active responding and feedback during mathematics classes. Teachers expected children to listen to them or to work quietly on their own most of the time. Children had very little written or spoken feedback from teachers, which is not surprising with more than 30 children in each class. Alton-Lee's (1983) work on social studies suggests that children learn a great deal by discussing concepts with each other, but in the classrooms observed for this study there was not a great deal of opportunity for peer interaction in mathematics. Small group activity directed at independent problem-solving was also very infrequent. Possibly teachers felt pressured to complete the appropriate amount of the syllabus in a formal manner.

As both boys and girls were getting 28% of problems wrong and the explicit feedback was both very sparse and contingent on presentation and accuracy, the learning context appeared one which provided insufficient opportunity to monitor or correct errors. The study did not show differential opportunity for feedback in boys and girls, but larger sample sizes of children would be needed to properly examine this issue.

Bronfenbrenner (1979) believes that primary developmental contexts promote development and learning. Glynn (1985, 1987) has found Bronfenbrenner's concepts useful in describing responsive and interactive social contexts where learning may occur. He argues that the social context needs to promote and reinforce initiations by the learner, provide reciprocal influence between more and less skilled participants, and give responsive feedback. The control in such social contexts should be shared between the more skilled and less skilled participants with the more skilled person taking a responsive rather than a controlling role. Classrooms currently have many constraints that prevent them from being responsive social contexts for learning. Teacher training strategies which encouraged teachers to make mathematics lessons into more responsive social contexts for children to learn would be likely to improve the mathematics skills for both boys and girls, and lead to a much more favourable climate in the mathematics classroom. Research at this fine-grained level of analysis would also allow further and more precise exploration of whether classroom teacher/child interactions in mathematics are such as to provide measurably different opportunities for learning mathematics for boys and girls.

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