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ABSTRACT

An urban independent middle school grouped its 63 sixth and seventh graders into single-sex mathematics classes (SSMC) to improve girls' achievement in mathematics (AIM) and attitudes toward mathematics (ATM) with no negative impact on boys. Researchers analyzed AIM, ATM, and interactions/instruction. AIM measures included Metropolitan Achievement Test-7, textbook unit tests, and teacher-constructed tests. T tests, alpha=.05, showed no significant differences in mean scores for males and females. Quantitative and qualitative analyses of ATM as measured on the Modified Fennema-Sherrnan Mathematics Attitude Scales (1993) and through standard open-ended interviews (Isaac & Michael, 1995) indicated positive ATM and SSMC. Observations, field notes, and videotapes provided data for analyzing expectations, interactions, and pedagogy. Using Cazden's (1986) definitions of teacher talk, significant differences were noted--an objectivist approach in boys' classes and a constructivist approach in girls' classes. Within a single-sex class, a range of learning styles calls for a variety of instructional approaches. (Contains 43 references.) (Author)

# Single-Sex Mathematics Instruction in an Urban Independent School

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Abstract

An urban independent middle school grouped its sixty-three 6th and 7th graders into single-sex mathematics classes (SSMC) to improve girls' achievement in mathematics (AIM) and attitudes toward mathematics (ATM) with no negative impact on boys. Researchers analyzed AIM, ATM, and interactions/instruction. AIM measures included Metropolitan Achievement Test-7, textbook unit tests, and teacher-constructed tests. *T* tests, $a = .05$, showed no significant differences in mean scores for males and females. Quantitative and qualitative analyses of ATM as measured on the Modified Fennema-Sherman Mathematics Attitude Scales (1993) and through standard open-ended interviews (Isaac & Michael, 1995) indicated positive ATM and SSMC. Observations, fieldnotes, and videotapes provided data for analyzing expectations, interactions, and pedagogy. Using Cazden's (1986) definitions of teacher talk, significant differences were noted--an objectivist approach in boys' classes and a constructivist approach in girls' classes. Within a single-sex class, a range of learning styles calls for a variety of instructional approaches.

## Objectives/Purposes[1]

Although co-educational schools have existed in this country since 1649 and co-education was widespread by 1900, instruction differed for boys and girls. Evidence in the fields of psychology, sociology, physiology, and education supported dissimilar education. Only recently has gender equity become a concern in American schools. The passage of Title IX in 1975 marks the beginning of systemic efforts to achieve gender equity in education. Mathematics and science have been of particular interest as areas in which girls' achievement tends to lag behind that of boys (Cuevas & Driscoll, 1993; National Research Council, 1989).

The research setting was a school which began single-sex mathematics classes (SSMC) for grades 6 and 7 in September, 1996. The change was based on the mathematics teachers' professional reading and perception that there existed a gender[2] gap in mathematics achievement. Their stated goal was to improve female achievement in and attitudes toward mathematics with no corresponding negative impact on male students. The research team aimed to determine to what extent instruction in single-sex mathematics classes (SSMC) affects mathematics achievement, attitudes toward mathematics, and instruction/interaction.

## Perspectives/Theoretical Framework

The nation's consciousness was raised by the 1991 American Association of University Women commissioned report *Shortchanging Girls, Shortchanging America*. The report revealed the impact low self-esteem has on adolescent girls' achievement in mathematics and science and their career aspirations (Greenberg-Lake, 1991). These results confirmed earlier studies (Belenky, Clinchy, Goldberger, & Tarule, 1986; Fennema & Ayer, 1984; and Gilligan, 1982) and sparked continued research on the gender equity practices of educators as related to content, pedagogy, language, and classroom interactions (Campbell, 1995; Gill, 1996; Noddings, 1992; Sadker & Sadker, 1994; and Tannen, 1994).

Attitudes toward mathematics influence students' achievement in mathematics and their decisions to take advanced mathematics and science courses (Fennema & Ayer, 1984; Greenberg-Lake, 1991; Ma & Kisher, 1997). Advanced mathematics and science courses act as gates to future study and career opportunities (National Research Council, 1989).

Concerns for gender equity in mathematics instruction are grounded in feminist theory that examines "the dominance of a patriarchal system and its debilitating effects on women and men alike" (Lincoln, 1992, p. 92). The recent literature has directed attention to the effects of the taught (Cuban, 1992) and hidden curricula (Eisner, 1992) in mathematics with regard to girls (Campbell, 1995; Fennema & Leder, 1990; Leder, 1995), including single-sex settings (Gill, 1996; Hildebrand, 1996; Mahoney, 1985; and Sebrechts, 1992). The importance of social interaction in students' construction of meaning (Cobb, Wood, Yackel, & McNeal, 1992; Sadker & Sadker, 1994; Tannen, 1994; Vygotsky, 1978; and Yackel, Cobb, Wood, Wheatley, & Merkel, 1990), the effects of teacher attributions (Fennema, Peterson, Carpenter, & Lubinski, 1990; and Weiner, 1974, 1994), and the fit between classroom activities and gender (Peterson & Fennema, 1985) continue to be the focus of research studies.

## Methods, Techniques, Modes of Inquiry

The research includes both quantitative and qualitative methods to answer questions related to achievement, attitude and instruction/interaction. The chart attached describes the specific methods and data to be used for each question. The Metropolitan Achievement Test-7 (MAT-7) was administered in October and May for achievement analysis. Where available, textbook unit tests and teacher-constructed tests were also used. Researchers administered a modified version of the Fennema-Sherman Mathematics Attitude Scale (1976) and performed *t* test of means to compare girls' and boys' scores and changes in scores from January to April. Researchers interviewed 8 students as key informants drawn from the students who completed the pretest and the 4 mathematics teachers using a standard open-ended interview format (Isaac & Michael, 1995). Data from transcripts were aggregated by sex to protect confidentiality and to compare girls' and boys' responses. Researchers observed and videotaped the four classrooms between December and March for teacher-student interaction data. Interrater reliability was maintained by comparison of field notes taken independently by two researchers simultaneously observing in the same classroom. Two researchers independently coded a sample of data to test for consistency in interpretation of Cazden's (1986) definitions of teacher-talk. All videotapes were analyzed independently by two researchers.

## Data Source/Evidence

### *Setting*

The setting was a small (113 students) private independent urban school serving grades 4-8 which has as its mission "to challenge minority and low-income children to succeed in college preparatory high school programs and to become community leaders." The student population includes 72% students of color. Ninety-one percent of the students receive half to full scholarships. All graduates have been accepted into college preparatory high schools. Thirty-nine of the 48 (81%) eligible alumni are attending college. The school is governed by a 36-member Board of Trustees and receives funding from endowment, government, special events, tuition, grants, and donations. Mathematics instruction follows the *Gateways to Algebra and*

*Geometry* textbook (McDougal, Littell, & Co., 1993), a classic college preparatory text. Portfolio assessment and joint parent-teacher-student goal setting are central to the curriculum. Students work in grades 6-7 multi-age classes, except for mathematics, where classes are single grade and single sex.

*Participants*

Participants in the study included all of the school's 63 sixth and seventh grade students. Distribution was as follows: sixth grade girls-21; sixth grade boys-13; seventh grade girls-11; and seventh grade boys-18. Also included were 4 mathematics teachers, 2 male and 2 female. The range of teaching experience was from novice to veteran.

*Measures*

*Achievement in Mathematics*

The MAT-7 mathematics test was administered by the school in the fall and spring. The test contains 54 items in the Concepts/Problem Solving subtest and 24 items in the Procedure subtest. Statistical analyses for achievement were performed using *Microsoft Excel.* An alpha level of .05 was used for all statistical tests. Scores from two teacher-constructed objective tests and four unit tests from *Gateways to Algebra and Geometry* were used as ongoing achievement measures.

*Attitude Toward Mathematics*

In January, the Modified Fennema-Sherman Mathematics Attitude Scales (1993) was administered by researchers. The same attitude scale was administered in April. The scale consists of four subscales: confidence, usefulness, perception of mathematics as a male domain, and perception of teachers' attitudes. Three scales consist of 12 items; the perception of mathematics as a male domain scale consists of 11 items. Half the items on each scale measure negative attitudes; half measure positive attitudes. Students responded to the 47 statements on a 5-point Likert-scale. All statistical analyses for attitude were performed using *SPSS for Windows, Version 6.1.2* (SPSS, Inc., 1995).

At the end of February, 2 students from each class, representing a cross-section of achievement in mathematics based on MAT-7 pretest scores, were selected as key informants. Each student was interviewed individually for approximately 15 minutes by a researcher. Responses were recorded on questionnaire sheets during the interviews. Data were aggregated by sex to protect confidentiality and to compare girls' and boys' responses. In March, researchers interviewed the 4 mathematics teachers individually for approximately 30 minutes. Responses were recorded on questionnaire forms during the interviews. Data were aggregated by sex of the mathematics class taught.

*Instruction/Interaction*

Classroom observation and videotaping were used as data sources for questions relating to interactions and pedagogy. Researchers observed SSMC for a total of 940 minutes of observation, in 30 minute sessions. Field notes were coded for large group, small group, and individual instruction, and for teacher talk as defined by Cazden (1986). Teacher talk was classified in one of five categories: 1) control talk, talk regarding control of behavior and of talking itself; 2) special lexicon, subject-specific language; 3) tentativeness indicators, words that express the speaker's attitude toward content of a lesson, for example "I know" or "I believe;" 4) humor, such as jokes and laughter; and 5) expressions of affect. A matrix was then used to compare data from observations of boys' and girls' classes. Ten hours of class time were videotaped. Tapes were analyzed for interactions and instructional mode occurring at regular intervals.

## Results/Point of View

*Achievement questions*

*1. To what extent does mathematics achievement differ for boys and girls?*

The MAT-7 pretest was used to determine the difference in achievement in mathematics (AIM) prior to the single sex groupings for mathematics instruction. Mean raw scores and stanines for the sixth and seventh graders combined were determined for each sex. Mean stanine scores were converted to percentile scores using the normal curve. Differences between boys' and girls' mean scores were not significant. Data and *t* test results are reported on Table AIM-1.

Although boys and girls did not differ significantly in stanine mean scores on either section of the pretest, the boys scored slightly higher on the total test and the Concepts and Problem Solving subtest, and the girls scored slightly higher on the Procedures subtest.

The range of scores for the boys was greater. On the Concepts and Problem Solving subtest, the difference between the high and low scores was 42 points for boys (50 to 8) and 30 points for girls (41 to 11). On the Procedures subtest the difference was 20 points for boys (24 to 4) and 16 points for girls (21 to 5). These results are consistent with findings of greater variability in achievement of boys (Fennema & Leder, 1990; Leder, 1992).

*2. To what extent does change in mathematics achievement differ for boys and girls?*

Mean stanines were converted to percentiles using the normal curve. See Table AIM-2. Mean pretest stanines were compared to mean posttest stanines by gender. See Tables AIM- 1 and AIM 2. Both boys and girls made gains on the total test and the Concepts and Problem

Solving subtest. The gains for boys were slightly greater. On the Procedures subtest, the girls lost .1 stanine. Although the difference in not significant, the direction for the girls is counter to the expectation of their stronger performance in this area (Leder, 1992). The change in percentile for boys is from 42 to 52, for girls from 34 to 39.

*3. To what extent does girls' achievement in SSMC differ from national norms?*

On the MAT-7, national norms at the fifth stanine represent a range from the 40-59%ile rank. Although the girls in the sample were closer to national norms following the single sex classes, some difference might be accounted for by the regression toward the mean. On the pretest girls' mean stanine is 4.3 and on the posttest is 4.5. both are on the low end of the average range. See Tables AIM-1 and AIM-2.

*4. To what extent do objective test results differ for boys and girls?*

Mean scores were computed for each common objective test by sex and grade. A Welch *t* test was computed for all tests. No significant differences were found. See Table AIM-3.

Sixth graders were given 2 common tests, which were teacher-constructed. The mean result was 83 for boys and 67 for girls. Although these scores appear quite different, this difference is not significant, because of the small sample size (v = 32). Seventh graders took 5 common unit tests. The mean for boys was 85, for girls 86. Although the girls' mean was higher on the unit tests in grade 7, some scores reported were higher than 100, indicating that extra credit was given. Weighted mean scores for combined sixth and seventh grade scores were 73 for girls and 85 for boys.

*5. Does the achievement gap differ with time in SSMC?*

The time span for pretest to posttest was approximately seven months. The gap was determined by subtracting the girls' mean scores from the boys' mean scores on the pre- and posttests and comparing the differences. The gap widened slightly. See Table AIM-4.

*Attitude Questions*

*1. To what extent do attitudes toward mathematics differ for girls and boys?*

Table ATM-1 presents the mean, median, and skewness of distribution of scores for girls and boys on each subscale on the January administration of the Modified Fennema-Sherman Mathematics Attitude Scales. A Welch *t* test for unequal *n*s and variance was used to compare the mean scores. The difference between the mean score of girls and boys was significant on the Confidence Scale. There were no significant differences between the mean scores on the Perception of Teachers' Attitudes Scale and the Usefulness of Mathematics Scale. The median scores indicated no significant differences on the subscales. The only exception was on Perception of Mathematics as a Male Domain Scale where girls' perception was four points higher. Attitude scores on each subscale were high for both girls and boys, indicated by negative skewness of scores for all subscales except for the Perception of Mathematics as a Male Domain Scale by the boys, which resembled a normal distribution.

*2. To what extent do girls' attitudes toward mathematics change with SSMC?*

Attitude scores on each subscale remained high for both girls and boys. Table ATM-2 presents the mean, median, and skewness of distribution of scores for girls and boys on each subscale on the April administration of the Modified Fennema-Sherman Mathematics Attitude Scales. A Welch *t* test for unequal *n*s and variance was used to compare the mean scores. The difference between the mean scores of girls and boys remained significant on the Confidence

Scale, with boys' mean score higher than girls', although both groups' mean score increased (not with significance). On the Perception of Mathematics as a Male Domain Scale, the means for both groups increased slightly, resulting in a significant difference between the girls' and boys' scores, with the girls' scoring higher on this subscale. There were no significant differences between the means on the other two subscales.

*T* tests were used to compare January and April scores for girls and boys on each subscale. Although changes occurred, none was significant. See Table ATM-3.

*3. To what extent do individuals report a change in attitude toward mathematics with SSMC?*

Based on individual interviews, students and teachers reported an overall positive attitude toward SSMC. The most frequent reasons cited were greater comfort levels and enjoyment of being with same-age classmates. Girls reported positive differences in their attitudes, including being more comfortable, outgoing, and interested in mathematics, and less afraid to make mistakes. Girls attributed greater ability to concentrate in mathematics class to this comfort level. Boys responded that they were not consciously acting differently and that the SSMC did not effect how or how much mathematics they learned. Teachers noted that both girls and boys seemed more confident, spoke out more often, took responsibility, and refrained from self-deprecating remarks, such as "I'm dumb" and " This probably isn't right." Teachers reported that students were working harder in mathematics, staying in at recess and after school.

*Instruction/Interaction Questions*

*1. To what extent do individuals report a change in attitude toward mathematics with SSMC?*

None of the student interview responses alluded to changes in attitude toward mathematics with SSMC. Student responses focused on the social climate in the classroom, not the subject taught. The boys' teachers report that boys are more confident in mathematics, but that this may be due to factors other than SSMC (e.g. small class size). The girls' teachers report that girls are including improvement in mathematics among their academic goals.

*2. To what extent do teacher expectations differ for boys and girls?*

The girls' teachers expect some confusion on specific topics and are empathetic as students work through problems. One teacher responds, "So you made a mistake this time" and conveys that it is not a problem. The boys' teachers emphasize speed and accuracy in problem solving: "Find a faster way...2 steps...one minute on a problem like this is perfect." Boys are frequently reminded by teachers that they should have the correct answer on the first try: "You are whispering wrong answers to me. That is a crime."

Girls are expected by teachers to assume more responsibility than boys in SSMC. Girls spend 14% of class time in small groups. They are expected to establish working procedures within the group. In one class, one student in each group is assigned the role of "TA (teacher's assistant)", which includes responsibility for grading and collecting homework and taking attendance. The boys spend 3% of SSMC time in small groups. Whereas girls move freely about the room and interact with other groups during this time, boys are required to remain seated and work only with the students in the teacher-assigned group. Girls are expected by teachers to be responsible for materials including manipulatives for the duration of a unit. The same materials are retained and dispensed by the teacher in boys' class.

*3. To what extent does pedagogy differ in SSMC?*

Learning modes differ significantly in SSMC. Videotape analysis indicates that the girls' classes follow a constructivist approach[3] to teaching and learning for 62% of the time and an objectivist approach[4] for 38% of the time. Boys' class time follows a constructivist approach for 6% of the time and an objectivist approach for 94% of the time. In the boys' classes, the teacher is the source of knowledge: "I know the answer. I want to see if you can get it." The girls' teachers work together with students to explore different methods of solving each problem.

*4. To what extent do interactions differ in SSMC?*

Interactions are distributed differently in boys' and girls' classes. Teacher talk represents 76% of talk in boys' classes and 45% of talk in girls' classes. Distribution of questions between teachers and students differs in boys' and girls' classes. In the girls' class, 60% of questions are asked by the teacher and 40% by students. In the boys' class, 90% of questions are asked by the teacher and 10% by students. Of the combined student and teacher questions, 81% are close-ended and 19% open-ended in the boys' classes. In girls classes, 64% of teachers and students questions are close-ended and 36% are open-ended. Special lexicon is used more frequently by boys' teachers. 41% of teacher talk in boys' classes is special lexicon, compared to 24% in girls' classes.

Control language is used more frequently in boys' classes. Control is the focus of 23% of the teacher talk in boys' classes and 15% of teacher talk in girls' classes. Control language in the boys' classes directs student attention to the teacher: "What are you paying to look at? Me." The girls' teachers use control language to focus students on group interactions: "I'm checking to see that your teams are started."

Discussion

In the area of achievement, the mean score for boys was higher than that of girls both on the MAT-7 pretest and posttest. The difference, however, was not significant. SSMC did not impede the performance of either group on objective tests and the MAT-7. These achievement tests do not show a narrowing of the gap between boys and girls. Research indicates that the gap begins to expand for students in middle school (AAUW, 1994). The limited sample size and lack of a control group due to the unique nature of the school preclude drawing conclusions regarding relative gains as a result of the SSMC. Both boys and girls did make gains on the posttest.

Teachers and students who were interviewed reported that most students seem to enjoy SSMC. This was reflected on the Attitude Toward Mathematics Scale with high mean scores for girls and boys on all the subscales. Some differences were significant. Boys' mean score was significantly higher than the girls' on the Confidence Scale. This finding is consistent with relevant literature reviews (Meyer & Fennema, 1988) which indicate boys tend to be more confident than girls, even when girls' performance suggests they may have better reasons to feel confident, based on their performance. Students' perception of mathematics as a male domain differs, with girls' perception significantly higher on the posttest. Differences on Perception of Teachers' Attitudes and the Usefulness of Mathematics subscales were not significant.

Discrepancies may be related to the administration dates. Students had already been in SSMC for half the school year when the Scale was first given and then readministered three months later. A more accurate measure of change in attitudes toward mathematics based on experience in SSMC may have been indicated by administration of the Scale earlier, perhaps at the end of the previous school year or outset of the current year. A paired *t* test for change in individual's attitudes toward mathematics may have been useful. The scale itself may have limitations. Since the means for all students were negatively skewed, the scale may not have measured the extent of students' attitudes.

Expectations, pedagogy, and interactions differ significantly between boys' and girls' SSMC. Teachers expected a high level of achievement in both boys' and girls' classes, but different means were used to achieve similar goals. An objectivist, teacher-centered approach is used by the boys' teachers, whereas a constructivist approach with teachers and students jointly solving problems is emphasized in the girls' classes. The boys' teachers stress speed and accuracy in problem solving and expect the correct solution as a student's first response. The girls' teachers reassure students that more than one attempt may be needed to solve a problem. Girls are expected to take responsibility for effective procedures in group work and for materials used in class. Boys' teachers maintain far greater direct control in these areas. Teacher talk characterized by close-ended questions, control talk, and special lexicon dominates interactions in boys' classes. Interactions in girls' classes are distributed more evenly between teachers and students. Less special lexicon and control talk is used than in boys' classes, and questions tend to be open-ended.

Current reform efforts in mathematics education (National Council of Teacher of Mathematics, 1989, 1991) call for teaching to focus on meaningful learning. Cobb, Wood, Yackel, and McNeal (1992) and others have illustrated teaching and learning for understanding in mathematics as constructivist classrooms which facilitate meaningful learning. Instruction and interactions within the girls' classes seem to align with the current view of mathematics teaching and learning. Separating students by sex for mathematics may not be the only way to address instructional students' needs. Incorporating a variety of teaching strategies, including a constructivist approach, in mixed-sex classes reflects the gender diversity of girls and of boys, recognized to be greater within groups than between groups (Campbell, 1995).

The observations of teacher-student interactions indicate a difference in instructional approaches in the girls' and boys' mathematics classes. The achievement testing reflects one approach. MAT-7 is a standardized, multiple-choice test, focusing primarily on declarative and procedural knowledge. The assessment of higher order thinking skills through another type of instrument, such as performance assessment (Wiggins, 1993), may more accurately measure the effects of mathematics instruction in classrooms exhibiting constructivist and behavioral approaches to teaching and learning.

Researchers, all female, are concerned with possible gender-bias. Segments of videotape were shown to educators of both genders to solicit their interpretations of classroom instruction and interactions. All viewers concurred with the researchers' interpretations.

## Conclusions

Teachers at the school site hoped that with the move to SSMC, girls would make gains and boys would continue to perform at their current percentile levels. These expectations were met and exceeded, as girls mean performance went from the 34%ile to the 40%ile and boys' mean performance went from the 42%ile to the 52%ile. Further study with a larger sample and over a period of time would be necessary in order to generalize regarding gains. A comparison and control group would strengthen the evidence in favor of SSMC. A longitudinal study of these girls in high school and beyond to measure their choices of higher mathematics courses might also prove valuable.

Beliefs and attitudes are generally stable, developed over time. The findings on students' attitudes toward mathematics from this study indicate that students' attitudes were high and did not change significantly during the SSMC. Research on affect in mathematics continues to study the relationship between attitudes, beliefs, and achievement.

Further research is needed to determine whether differences in expectations, pedagogy, and interactions are attributable to SSMC or to other variables. Class size was mentioned by teachers as a variable that may have affected their instructional approach. Observation of the same teachers in both male and female single-sex classes and mixed-sex settings is needed to determine whether teachers alter their instruction in any way to meet perceived needs of a male or female group. The findings also raise the question of how teachers combine a variety of instructional approaches to meet diverse learning needs of any group of students. The research findings suggest that if mathematics is taught in mixed classes, a variety of instructional approaches is critical to meet the learning needs of boys and girls. This does not mean that any single approach is appropriate for a single-sex class. This conclusion is supported by the work of Nyborg (1994) who argued that instruction should be geared to a sex continuum, not a sex dichotomy. Within a single-sex class, there may still be a range of learning styles represented, calling for a variety of instructional approaches. Longer time and larger samples across a variety of instructional settings are needed to determine if single-sex grouping for mathematics instruction correlates with statistically significant achievement differences.

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# Endnotes

1. We wish to acknowledge the helpful comments of Dr. Betty Young and Dr. Theodore Kellogg on earlier drafts of this paper. This study was conducted as a field research project in conjunction with course work in the Joint Ph.D. in Education program at the University of Rhode Island (URI) and Rhode Island College (RIC). However, the opinions expressed herein do not necessarily reflect the position or policy of URI or RIC.

2. According to Deaux (1993) in Woolfolk (1995), "*gender* usually refers to judgements about masculinity and femininity, judgements that are influenced by culture and context. In contrast, *sex* refers to biological differences" (p. 171, emphasis in original). In this paper these terms are used interchangeably.

3. "A constructivist approach . . . emphasizes the active role of the learner in building understanding and making sense of information" (Woolfolk, 1995, p. 481).

4. Objectivism is a belief that knowledge is stable and unchanging with the assumption that learners gain the same understanding about what is transmitted. Meaning is thus not subjective, but absolute (Jonassen, 1991).

| Achievement in Mathematics | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Test | Raw Score | | | Stanine | | | Percentile | | Standard Deviation | | Range | |
| | Boys | Girls | *t* test | Boys | Girls | *t* test | Boys | Girls | Boys | Girls | Boys | Girls |
| Concepts and Problem Solving | 26.66 | 23.31 | 0.22 | 4.9 | 4.6 | 0.52 | 48 | 42 | 2.3 | 1.3 | 50 - 8 | 41 - 11 |
| Procedures | 12.3 | 11.9 | 0.77 | 4.0 | 4.1 | 0.86 | 23 | 26 | 1.9 | 1.1 | 24 -4 | 21 - 5 |
| Total | 38.97 | 35.24 | 0.33 | 4.6 | 4.3 | 0.59 | 42 | 34 | 2.1 | 1.2 | 74 - 14 | 62 - 18 |

Table AIM-1. October results.

| Achievement in Mathematics | | | | | | | |
|---|---|---|---|---|---|---|---|
| Test | Raw Score | | Stanine | | | Percentile | |
| | Boys | Girls | Boys | Girls | *t* test | Boys | Girls |
| Concepts and Problem Solving | 30.03 | 33.58 | 5.0 | 5.5 | 0.28 | 59 | 30 |
| Procedures | 14.3 | 14.8 | 4.0 | 4.2 | 0.77 | 30 | 23 |
| Total | 44.41 | 48.38 | 4.5 | 5.1 | 0.24 | 52 | 40 |

Table AIM-2. April results

| Unit Tests - Mean Differences | | | | |
|---|---|---|---|---|
| Grade | Test | Boys | Girls | *t* test |
| 6 | Test 1 | 86 | 64 | 0.006 |
| | Test 2 | 81 | 68 | 0.055 |
| 7 | Unit 3 | 86 | 85 | 0.916 |
| | Unit 4 | 86 | 79 | 0.183 |
| | Unit 5 | 84 | 93 | 0.014 |
| | Unit 6 | 86 | 84 | 0.699 |
| | Unit 7 | 83 | 88 | 0.343 |
| Totals Weighted | | 85 | 73 | |

Table AIM-3.

| Achievement in Mathematics | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Test | | Raw Score | | Stanine | | | Percentile | |
| | | Boys | Girls | Boys | Girls | *t* test | Boys | Girls |
| Concepts and Problem Solving | Posttest | 33.58 | 30.03 | 5.5 | 5.0 | 0.28 | 59 | 50 |
| | Pretest | 26.66 | 23.31 | 4.9 | 4.6 | 0.52 | 48 | 42 |
| Procedures | Posttest | 14.8 | 14.3 | 4.2 | 4.0 | 0.77 | 30 | 24 |
| | Pretest | 12.3 | 11.9 | 4.0 | 4.1 | 0.86 | 24 | 26 |
| Total | Posttest | 48.38 | 44.41 | 5.1 | 4.5 | 0.24 | 52 | 40 |
| | Pretest | 39.37 | 35.24 | 4.6 | 4.3 | 0.59 | 42 | 34 |

Table AIM-4.

| Mathematics Attitudes Scale | | | | | | |
|---|---|---|---|---|---|---|
| Subscale | Girls ($n$ = 34) | | | Boys ($n$ = 29) | | |
| | Mean | Median | Skewness | Mean | Median | Skewness |
| Confidence | 46.88* | 49.00 | -0.84 | 49.52* | 49.00 | -0.33 |
| Male Domain | 50.12 | 51.00 | -1.12 | 47.07 | 47.00 | .00 |
| Teacher Attitude | 49.82 | 51.00 | -1.63 | 51.93 | 52.00 | -0.53 |
| Usefulness | 53.56 | 55.00 | -1.00 | 52.72 | 54.00 | -0.77 |

* $p<.02$

Table ATM-1. January results.

| Mathematics Attitudes Scale | | | | | | |
|---|---|---|---|---|---|---|
| Subscale | Girls ($n$ = 31) | | | Boys ($n$ = 30) | | |
| | Mean | Median | Skewness | Mean | Median | Skewness |
| Confidence | 47.48* | 48.00 | -0.81 | 52.47* | 54.00 | -0.88 |
| Male Domain | 50.45** | 51.00 | -1.11 | 47.60** | 49.00 | -0.90 |
| Teacher Attitude | 50.45 | 50.00 | -1.22 | 50.83 | 50.50 | -0.39 |
| Usefulness | 51.19 | 52.00 | -0.42 | 52.30 | 54.00 | -0.65 |

*$p<.002$; **$p<.012$

Table ATM-2. April results.

| Changes in Mean Scores on Mathematics Attitudes Scale | | |
|---|---|---|
| Subscale | Girls | Boys |
| Confidence | 0.60 | 3.25 |
| Male Domain | 0.33 | 0.53 |
| Teachers' Attitude | 0.63 | -1.17 |
| Usefulness | -2.37 | -0.42 |

Table ATM-3. January to April.

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