Gender Based Achievement, Enrollment, and Self-Confidence Gaps: Mathematics at Trinity College

Charlotte Grassi
Trinity College
Ed 400
Research Question

• Do gendered achievement, enrollment, and self-confidence gaps exist on the college level?

• If so, are the differences significant? What factors explain the differences and why are the gaps important?
Defining Terms: Achievement Gaps

- Differences between how well males and females perform on measures of math achievement
- Gender based achievement gaps in math are positively correlated to, and heavily dependent on age
- Achievement gaps grow as students get older
Defining Terms: Enrollment Gaps

• Differences between the number of males and females voluntarily enrolled in math courses.

• Voluntary participation gaps in math courses are shrinking.

• However, college-bound female high school students are disproportionately more likely than college-bound males to cease their mathematics career upon completing Algebra II.
Defining Terms: Enrollment Gaps (cont.)

• “Stopping a math education at this level can close the door on future studies, scholarships, and careers” (AAUW, 1999).

• In high school more males than females enroll in upper level math classes, significantly increasing the chances that sex-based gaps in math enrollment will continue to exist in college.
Defining Terms: Self-Confidence Gaps

- Biased instructional techniques in elementary and middle school classrooms serve to systematically disadvantage female math students.
- Self-confidence in math skills is positively correlated with related with achievement and enrollment.
The Case for Quantitative Literacy

• “As our society is driven increasingly by science and technology the need to establish levels of quantitative literacy becomes ever more important” (Rita Colwell)

• “More important for many people are the rapidly increasing uses of quantitative thinking in the workplace, in education, and in nearly every other field of human endeavor” (The National Council on Education and the Disciplines)
“Academic Mathematicians point out that the quality and quantity of mathematics students who received their secondary and college mathematics education in the United States have reached dangerously low levels” (Wade, Ellis, Jr.).
Combating Gender Gaps

- To solve this significant social dilemma, educators and law makers have attempted to increase female participation in math by emphasizing preventative instructional techniques and single-sex education.
Instructional Techniques

• Research suggests that gender biased instructional techniques in math classrooms serve to systematically disadvantage female math students and damage their confidence in their math skills (Jewett, 1996).

• Differential socialization in and outside the classroom encourages autonomous learning behaviors in males and dependent learning behaviors in females (Fennema & Peterson, 1985).
Instructional Techniques

- Research suggests that males and females employ very different strategies to solve math problems.

- Males tend to use visual-spatial skills to solve math problems, while females tend to use verbal-analytical strategies.

- Verbal skills receive more emphasis than spatial skills in elementary curriculums.

- Females experience less exposure to visual-spatial activities outside of school.
Single-Sex Education

• Differential socialization and hidden curriculums in the classroom are used as arguments for single-sex education

• There is mixed evidence on the effectiveness of single sex education and achievement, persistence and self-confidence in math

• Besides the NCLB provision, single-sex schools are offered in private schools, restricting access to students from lower SES families
Research Significance

• The research is outdated and disproportionately examines gaps on the elementary level.

• More research into gender differences on the college level is needed to understand the pervasiveness and durability of gender based gaps in math and the effectiveness of single-sex education.

• Research on the college level is needed to further our understanding how females are significantly disadvantaged in a technologically advanced society where quantitative literacy is more important than ever before.
Gender gaps in math achievement, enrollment and self-confidence at exist at Trinity.

Trinity Females from single-sex schools report similar levels of math anxiety to females from co-ed schools and do not score significantly higher on measures of math achievement.

Significant gender based gaps in math achievement, enrollment, and self-confidence gaps suggest that females are not as quantitatively literate or interested in mathematics as male students.
Quantitative and Qualitative Analysis

Quantitative Analysis
First year students’ SAT-Math scores high school type, and Trinity College Quantitative Reasoning Test scores. The study also examines sex-based enrollment gaps in Trinity College math classes.
Research Methods (cont.)

Quantitative and Qualitative Analysis

Qualitative
40-item, 5-point (1-Strongly agree, 2-Agree, 3-Neither agree nor disagree, 4-disagree, 5-Strongly disagree) Likert-format questionnaire

Measures perceptions of gendered gaps in math, students’ self confidence in their math skills, and students’ experiences with math and visual-spatial reasoning.
Achievement Evidence

Males students score disproportionately higher than females on all measures of mathematic achievement (SAT, Trinity College Quantitative Reasoning Exam)

Female students from single-sex high schools scored the lowest on all measures of achievement
Results

Math SAT and Gender & High School Type

<table>
<thead>
<tr>
<th>Gender and HS</th>
<th>Mean SAT</th>
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<tbody>
<tr>
<td>Female Coed</td>
<td>620</td>
</tr>
<tr>
<td>Female Singlesex</td>
<td>630</td>
</tr>
<tr>
<td>Male Coed</td>
<td>640</td>
</tr>
<tr>
<td>Male Singlesex</td>
<td>650</td>
</tr>
</tbody>
</table>

The graph shows a significant difference in mean SAT scores between genders and high school types. The t-test indicates a p-value of 0.0001, suggesting a statistically significant difference.
Results

Numerical Reasoning Score and Gender & HS

<table>
<thead>
<tr>
<th>Gender &amp; HS</th>
<th>Mean NUM.RES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male Singlesex</td>
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</tr>
<tr>
<td>Female Singlesex</td>
<td>14.5</td>
</tr>
<tr>
<td>Male Coed</td>
<td>15.5</td>
</tr>
<tr>
<td>Female Coed</td>
<td>14.0</td>
</tr>
</tbody>
</table>

The graph shows a significant difference in numerical reasoning scores between male singlesex and male coed students, with male singlesex students scoring significantly higher. The p-value is <0.0001, indicating strong statistical significance.
Results

Enrollment Evidence

331 males and 266 females enrolled in a math class during the 1st Quarter of the 2004-2005 academic year.

17% of male students and 14% of female students were enrolled in a math course.
• The results of this study support my thesis and suggest that there are significant gender-based achievement and enrollment gaps in mathematics at Trinity.

• This study suggests that single-sex education does not advantage females educated in a single sex environment over females educated in a co-ed environment.
Conclusions

• Quantitative literacy matters more so today than ever before

• Gender based gaps in mathematics on the college level suggest that female college students are positioned at a significant disadvantage when entering the workforce after they graduate.


