

Research & Teaching Project:

What are the Effects of Single-Gender Education
in Secondary School Mathematics on Female Students?

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Abstract

This paper shows the connections between fifteen articles that discuss topics relating to the research question: What are the effects of single-gender education in secondary school mathematics on female students? The purpose is to review these pieces of literature in a way that examines not only both hypotheses stemming from this questions but also alternative viewpoints not already considered. By citing various pieces of research findings and other academic and social writings, it has come to my attention that there are many factors which can contribute towards this question and issue. The world of education has not been silent on the topic for many years, and possibilities are still being discussed and put into practice. Single-gender education for girls in math is a way that, for some supporters, seems to be the answer to countless gender differences between male and female students. For others, the idea is either unnecessary or contributes to opposite, negative results for both genders. While results remain inconclusive in relation to my research question, the practice is one can still be gone forward with and explored, as long as it is done so in a way that focuses on individual students who might benefit most from such an environment and under what conditions they might do so.

Keywords: single-gender education, mathematics, female students, secondary education

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Research & Teaching Project:

What are the Effects of Single-Gender Education in Secondary School Mathematics on Female Students?

Focus and Rationale

I want to investigate how single gender education affects the perception of abilities, interest in learning, and academic success for girls when they experience a girls-only classroom for middle school math classes. In other countries, I have heard of single gender education as being more common than in the United States, but still some schools—and not only private schools—are trying this approach in some courses. I have heard it most common in Physical Education and Math classes. At the school I teach at, we currently have middle school students take 1.5 math courses: they take their regular, eighth grade math class year round in a mixed gender setting and a half-year remedial course that is single-gendered. The half-year course is intended to remediate and enhance skills through self-paced, internet-based lessons that are supplemented with face-to-face instruction and assistance. I currently teach the mixed gender math classes, but have heard many positive reviews about the single gender classes from both the teachers (both females) and many of my students. I am interested in how other schools are employing this strategy and what successes (or lack of them) they are experiencing.

In the world of education, teachers are constantly being looked to for the next big solution to the question of why kids aren't learning as much as they could/should. We always want to improve our methods to bring more kids "up to the bar" that's been set—whether that bar comes from the global, national, state, school, or parental level. I know that this is one method that is argued by some to have promise, and I've heard a few personal testimonies. I've heard many female students report that they actually enjoy their girls-only math class more than their other classes because they can focus more on

learning, without the drama that exists in the rest of their middle school lives creeping in as much. I've also heard from teachers that there are far less behavior issues on both gender sides when they are in a single gender environment, and that students seem to show growth in competency faster and with greater accuracy in their single gender classes. It makes me wonder: why do some of the students in my mixed-gender class struggle so much when they are doing so well in their single-gender math class that is just one hour different in the day? Does it have to do with the fact that they are in a different mix of kids—a more specific mix—and therefore actually learn differently? My suspicion is yes, and so I am looking forward to exploring this issue further. I have a hunch that single-gender classes may be an answer for many girls who need an increased focus and drive for success in mathematics. I believe that math classes specifically will show great benefits, as the world of mathematics in particular has great gender stereotypes attached to its name. And if I am right, I feel that students and teachers alike can benefit from the evidence found in both candid interview questioning and academic assessments. We all want to improve student attitudes and fondness for the subjects we teach just as much as we do their test scores, and I'd like to explore the idea that this might be a way that can be shown to work.

Literature Review

The question of whether or not single-gender education is the way to go for students of various ages and disciplines is one that has gained much attention over the years. Researchers, teachers, parents, and students have considered the issue from several points of view. In 2006, the federal government opened new possibilities for single-gender education in the public school realm, but not before others had already taken a stab at it. Under the rewritten Title IX law, local districts can now provide single-gender education under a small list of conditions (P. Meyer, 2008). It is through this paper

that several pieces of research on this topic will be explored, specifically attempting to answer the research question, “What are the effects of single-gender education in secondary school mathematics on female students?” I am interested in not only the potential academic effects but also the social effects that may be evidenced as result of female students participating in single-gender math education.

Perspectives

One of the greatest outcomes of my research is now being able to understand how many other factors seem to contribute to the gender gap in math education—far beyond what I had thought about before on my own. The social ramifications and potential for greater academic confidence (and therefore success) are only the beginning, according to research done by the Department of Sociology at the University of California as early as 1980 (Penner & Paret, 2008). In this early work, differences between the learning of boys and girls were shown to surface as early as kindergarten. Other factors that Penner and Paret attribute with affecting learning differences are race and family background (2008).

Among those who support single-gender classes at the secondary level are two main beliefs: single-gender classes are better because the genders are different types of humans, and single-gender classes are better because the genders have unique experiences and social needs (Weil, 2008). From the biological perspective, we find arguments that the way that girls communicate and receive information is different because they make use of their senses differently than boys do. The social issue comes into play in the way girls experience challenges and successes differently. In research described by Elizabeth Weil in her *New York Times* article on the matter, not only the physiological make ups of the boy brain and the girl brain are emphasized, but also how the two genders interact within their groups are used as

evidence of the need for separation (2008). A third, less prominent view point is the argument that separating by gender makes as much sense and is as simple as the way schools are separated by age (J. Meyer, 2009). I'm not entirely convinced that it really is "that simple," but the point has been made and it does make sense that it might be time to consider the issue from a deeper perspective.

A main contributing factor to how girls and boys perceive math and how readily they study it stems from the stereotypes placed on each gender as to how well each should perform in math classes (Sadker and Sadker in Ma, 2008). This perspective is an interesting one, as it points to parents and teachers first, rather than looking at natural brain compositions for reasons why one gender may excel at or enjoy math more than the other. According to researcher Xin Ma, the parental perspective seems to tie closely to economic ones, as well as to regional differences and individual teacher beliefs.

Not everyone views the gender gap as a reason to separate the girls from the boys, however. An alternative view to single-gender education grows out of the very nature of differences between the genders as well. In an article adapted from a study by Tel Aviv University, Science Daily writers describe the benefits of having a mixed-gender education (2008). Girls can actually tame the boys and the boys can encourage the girls to work harder. Higher percentages of girls in the classroom (at least 55 percent) have also been attributed with causing a better relationship to be built between the teacher and students (Science Daily, 2008). Teachers are said to be less tired and more focused with more girls in the classroom, though this is a perspective that is likely less often considered, regardless of validity.

Education researchers are not the only ones interested in the affects of gender differences on our education system. In an article about single-gender education in public schools by New York Times writer Jennifer Medina, the social ramifications of girls excelling at math in front of boys and their impact on confidence levels in girls are outlined (2009). Medina's piece is focused on another option for

studying and conducting single-gender classrooms: teaching the genders in separate rooms in the same school. The most significant benefit named by teachers in this article is the decrease in behavior issues for both genders (Medina, 2009).

In the beginning, single-gender classrooms were marketed to parents as a way for girls to “get away from the boys,” because it would be better for female students to learn independent from males. New research, however, also points to the betterment of the boys’ education in this setting (Dachel, 2009). It appears that single-gender education for girls in math may do as much for those who the girls are being removed from, and so everyone can benefit if the system is run well.

Pedagogy

In 2009, there were 95 single-gender public schools, with many more trying out classrooms that were single-gender within an otherwise coed school (Medina, 2009). This number has grown even in the last year. Currently, there are at least 547 public schools that offer a selection of single-gender classes within their coeducational design—a growth from only 11 schools in 2002 (J. Meyer, 2009). In parochial and private schools, the separation of genders has been common for some time and has been believed to be successful for some time (Weil, 2008). The success experienced by many of these schools begs us to ask: what are they doing that we need to consider for the benefits of other students?

Because so much of the research encouraging single-gender math education for girls is supported by evidence from the scientific community showing that girls and boys actually do learn and grow differently, new teaching methods must be formed to align with these acknowledged needs. In, “With Boys and Girls in Mind,” researchers Michael Gurian and Kathy Stevens point out that “structural and functional differences [between genders profoundly] affect human learning” (2004, p. 21). They go

on to say that girls should in fact go on to all of the same career paths as their male counterparts, despite the differences in brain development. The intention is that teachers will teach specifically to the individual sexes and prepare them towards the same end within different classrooms.

Some of the other big arguments supporting single-gender education for girls in math (or any other subject) have less to do with the gender gaps from human development and structure, and more to do with how effective the separation is for classroom management purposes. These alternative viewpoints have their grounding in the social benefits provided in having a girls-only classroom. According to Gurian and Stevens, male students are responsible for 90 percent of discipline problems, two-thirds of the learning disorders, and the majority of the failing grades (2004). Through interviews of teachers and students we find that girls don't always miss boys when they are without them and that the boys often feel the same (Medina, 2009).

Girls who do enjoy learning in their new, girls-only environment are quoted as saying they are more willing to speak out and that they no longer feel nervous about what boys will think of them (Dachel, 2009). In this study by Jarod Dachel for his master's dissertation, girls were actually removed from a mixed-gender education setting for eight months and are not only observed, but interviewed as well. Interview questions are varied between asking about how they feel the learning environment has changed and how much they are enjoying the material being taught. His analysis of the results points towards needing to design classrooms so that girls have a voice that is both valued and affirmed. But as we focus so much on teaching girls in a way specific to them and apart from boys, we also need to gear the other classes towards the boys as much as possible. Girls can be taught from the understanding that they focus on relationships and nature more, whereas boys crave a focus on the mechanical side of the world. The idea behind using this as the basis for all teaching methods is to create new opportunities for

learning and to place students where they can feel more successful because of what they understand best about the world than they do in traditional coed classes.

One type of mathematics classroom where single-gender education has been tried out at the public school level and found successful is that of the gifted student population of girls. It is here that the gap between genders and their achievement is the widest (Abbott 2007). Teachers are teaching to differences in cognitive, social, and emotional development of their students with a very specific goal: math achievement. To do this, girls are encouraged to discover math through its relational side, which is the side it is believed girls can relate to the most. The point is to remove gender stereotyping from the mix and to allow female students to achieve to their greatest heights. Also, an emphasis is placed on career exploration and girls are encouraged to consider possibilities for their future that commonly have stereotypes attached to them. Through his research and dissertation, Steven Abbott found that the gender gap was bridged in mathematics for the female gifted student when placed in a classroom where she could explore math alongside other students with a craving and ability to learn at the same caliber (2007).

Although this teaching style has been growing in the United States, most studies are still said to be inconclusive, and the single-gender classroom is still considered experimental in schools (Dachel, 2009). In answer to many critics views about how separation of the genders might create a void in proper communication and socialization between genders, many researchers answer that these skills will be learned through the natural course of life and do not need to be met within the mathematics classroom (or other classes) (Garcia, 2009). Another fear is that one gender will be left out in time and the gender gap will only widen as we seek to best meet the needs of girls. After one study conducted by the American Association of University Women (AAUW), it was found that some schools were becoming

so good at attempting to accommodate girls that they began leaving the boys behind instead (P. Meyer, 2008). Whatever attempt we make towards success for girls in the math classroom, it is going to be imperative that we meet it with an equally structured and intentioned version for the boys.

Assessment

As research has grown over the last decade, teaching methods that keep gender differences in mind have taken off in many areas and increases in student abilities and interest in math have been cited in the work of education researchers. However, it has been debated when, if they do play a significant role, gender differences begin affecting students. Before the 1980s, most studies agreed that differences in academic performance due to gender were slight during early elementary years and grew more noticeable only towards high school years, where boys outperformed girls on standardized tests (Ma, 2008). In the more recent report by Penner and Paret, the difference among the general population of kindergarteners has been shown to be relatively insignificant in observable behavioral skills as well as academics, though the gap is slightly larger when considering the more gifted students of that age group (2008). From the perspectives of recent research, as students progress through their years of school girls lag behind boys less and less; in recent years even areas such as math—where girls have traditionally been behind—show only minor gaps in the general population (Gurian & Stevens, 2004).

Studies on this matter have been conducted in a variety of ways, with varying depths. In 1993, there was a 50-point gap between girls and boys on the math portion of the SAT (with female students in the deficit), and several California schools began experimenting with single-gender classes to improve standardized test scores by having students take their SAT before and after being a part of single-gender preparatory classes (Gross, 1993). At this point, schools still faced potential legal ramifications if they

were not careful with how they structured these sorts of classes due to the expectation of what a public school would provide for all students. They got around the possible trouble by calling the classes “for girls” but saying that boys could technically enroll if they chose to—though none did. As these few schools began experimenting with little attention given to what was being done, scores for girls rose significantly compared to those who remained in traditional classrooms (Gross, 1993).

As research is reviewed and accumulated, the data reported from multiple countries shows little variations. America and Britain, two of the most current and prolific research sites for the issue of gender differences affecting education, remain consistent in showing how math achievement on standardized tests as well as school-wide performance is different for males and females (Ma, 2008). In the research by Xin Ma for the *Comparative Education Review*, a population of 15-year-old students was targeted and standardized tests were compared between the genders, with at least 14 variables believed to be at work in the matter. Results showed that math achievement swayed several points in favor of female students when isolated from the rest of the population (2008).

For younger students than those my question looks to study, it seems that gender-specific classrooms can encourage female students to work harder and be more confident in their abilities. Celeste Dunlap looked at this phenomenon in fifth grade girls in her 2002 thesis by studying female student’s beliefs about mathematics and their interest in the subject through a careful, intermittent interview process. Dunlap performed this study by creating a short questionnaire that she administered to a group of female students both before and after they experienced a single-gender learning environment. She asked the same questions on both ends of the study and tabulated results. When asked to identify their favorite subject while experiencing coed classes, twenty-eight percent of the girls chose math as their favorite; later, after seven weeks in a girls-only math class, thirty-six percent of the

students chose math as their favorite (Dunlap, 2002). Although the difference here is not great, she does go on to say that even with few changes of opinions about math, the students' confidence levels increased more dramatically in how successful they felt they were at math. This seems to point to there being some basis for at least certain students doing better in single-gender math classes, although the amount of difference it makes remains in question.

Another study conducted for one teacher's dissertation focused on the social ramifications of having single-gender classrooms for female students, but with alternative outcomes. In her piece titled "Single-Sex Classrooms: Do They Impact Absenteeism, Academic Achievement, and the Drop-out Rate?" Tracy Brittmon found that, although there were improvements in standardized test scores for girls in girls-only classes at the secondary level, interviews with students showed that beliefs and experiences on a personal level remained unchanged (2008). To uncover this information, Brittmon monitored standardized test scores over time as they were reported by the students themselves. She also conducted one-on-one interviews that allowed her to ask the same series of questions to each student while monitoring the depth of thought given to each answer. Another target population of her study was the teachers themselves, who also reported similar observations that the social choices relating to education which were named in the title of her study seemed unaffected by having the female students in separate classes from the males (Brittmon, 2008). The results of this study are specific and do not show a correlation between the increased test scores experienced by those in single-gender education and an improvement in female beliefs about education or their desire to pursue that education. Attitudes seem less affected than abilities.

To pilot such a program at the secondary level seems a risky but still promising course of action. This coming fall, one school in Prince William County in Virginia will be reaching out to expand their

single-gender education opportunities to its middle school students (Buske, 2010). For high school students in the district, this practice has been coming on slowly but consistently each year since 2007. Based on standardized test scores, the district believes the gender gap in performance has decreased in certain subjects, including math, and that attendance has improved (Buske, 2010). Although this research is not outlined with specific data, parents and the community in the area are the main audience, and it would likely have effects due to the nature of the report and the questions used in personal interviews. It seems that the case for academics is the focus, rather than attitudes and confidence experienced by students, and this is the argument that generally gets the most attention. The results of this attempt will obviously be coming at a later time.

Conclusion

After several years of debate and study, researchers have begun to put an emphasis on the importance of personal choice in regards to the education of children instead of a decided method for all students. In 2005, the American Institute for Research brought the previous decade's worth of research together under review to find that roughly one-third of studies conducted reported greater academic accomplishment through single-gender education (P. Meyer, 2008). Peter Meyer went on to point out, however, that the remaining percentage of studies that did not report a gain in academics was no more conclusive towards the contrary. Through all of my reading and researching, I have definitely found this to be the case: while some studies about single-gender classes for girls claim to be conclusive because they show positive results, there will always going to be alternative studies that either say otherwise or point to nothing conclusive at all.

The single gender issue is about so much more than girls gaining confidence and finding a voice; it is about figuring out how to teach each gender—each child—in the best way we know how. Despite

the breath of research done in the past and being conducted currently, we cannot say for certain whether or not single-gender math education is the answer for all adolescent girls. We can, however, say that it is a method that seems to work for some students and is worth experimenting with as we learn more about students, how they learn, and how their interactions with others affects their opinions and beliefs, as well as their depth of knowledge and competency with mathematics.

Research Design

Research Question

My research will investigate the question, “What are the Effects of Single-Gender Education in Secondary School Mathematics on Female Students?” by investigating the following hypotheses:

Null Hypothesis: There is a decrease or no gain in the attitude of female students towards math through having a single gender math education at the secondary level and/or a decrease or no gain in assessment scores.

Alternative Hypothesis: There is an increase in the attitude of female students towards math through having a single gender math education at the secondary level and/or an increase in assessment scores.

Procedures

Data collection will occur through both theoretical and empirical study over an entire school year. I plan to gather numerical data about student test scores as well as information about student opinions and preferences about their math classes. I will gather the personal thought data through one-

on-one interviews with the students so that any conclusions drawn as a result of the interviews will remain consistent. Upon completion of this one-year study, a second year of investigation will take place under the same parameters with a new group of students who have been unexposed to the study to attempt to draw more definite conclusions about the results. Because the idea of single-gender education is no more a new idea than it is an easily agreed upon one, I will study the idea from a perspective of finding out not only whether or not my alternative hypothesis is supported through my research, but also what kinds of female students seem to be affected in each way.

My unit of analysis will be individual female students in three variations of mathematics classrooms: those who exposed only to bi-gender mathematics education, those exposed to only single-gender mathematics education, and those who experience each method of math education at different points in the same day. The first of these groups will serve as the control group while the latter two will be the test samples. Because a part of the data recorded will come from personal interview and survey (discussed in the following section), subjects will be chosen from multiple schools with a diverse student population and assessments will be administered from a third party who is unlikely to have personal relationship with any of the test subjects. Another side of this diversity in test population will be choosing both female students who show previous interest and/or confidence and female students who show previous disinterest and/or lack of confidence prior to instruction in the single-gender environment. The schools which are chosen to participate will be required to be offering both single-gender and heterogeneous mathematics classes.

Assessments

I will investigate the theoretical side of the issue (which focuses on student interest levels in regards to mathematics) through careful and consistent interviews and written survey. I will conduct

initial interviews and polls prior to single-gender instruction taking place, followed by a second study mid-way through the year, and a third at the end of the school year. These assessments will ask students to score their own perceived abilities in mathematics, confidence in their ability to learn the material, and enjoyment of their mathematics classes. Most survey questions will be designed to allow students to rate their answers on a number scale, with a few open ended questions beginning with phrases such as, "Describe what comes to mind when..." Students will be unaware that the study is only looking at female students, so as to avoid skewing of data towards the desired or undesired ends.

The qualitative data will couple with the quantitative study of scores, looking for changes over time. This empirical side, however, will occur in a more natural setting, as I will be monitoring student performance levels over time for both standardized and classroom assessments given to all students involved in the study throughout the school year. According to the research I have reviewed in preparation for this study, this method will best suit my needs because the assessments will already be in place and will have nothing to do with the study, thus allowing the mathematics questions to be unaffected by the research question or hypotheses at all. This research piece will be secondary to the changes happening within the female students' belief systems. Both of my research pieces will respond directly to the research question asked. The findings will lend to either an affirmation of one of the hypotheses or an alternative blending of the two. By exploring the study through identical assessments and test groups formed in a similar manner for a second school year, I will be able to affirm my findings when trends are more firmly established.

By studying both the opinions and academic successes of the students being studied, I hope to create a separation between conjecture and fact. Measuring test scores for assessments given to all students allows the improvement of students to be made clear or shown to be otherwise. Support is

also further substantiated when it comes from actual people in addition to numbers. By asking students about their own perceptions of their abilities in math, we can see the changes in people (the students) taking place over time. We can watch as the actual people are changed by the experience, and this very important to me as I consider best practices in regards to math education. I hope to experience what is to come of female students' thoughts about what they can learn and just how far they can go, as well as how much they enjoy the thrill of the ride along the way.

Design Rationale

This research design will yield good data for answering the research question because it will directly answer the two very different sides of the question. One, a theoretical issue, needs careful consideration because it involves a highly subjective data set that relies completely on the honesty and perceptions of the female students. Thus, students who are more self-aware will give more reliable answers but all answers will be taken into account. However, this study can also be considered the best option because the question itself begs us to consider what is best for our students—and only those students can become experts on what serves their learning needs the best.

Being unobtrusive is important when hoping to conduct a study driven by honesty and authentic results. Because I am choosing to not institute any new academic assessment pieces to study participants with, I will be keeping my research in the background of what is happening within the classroom as much as possible. Approaches to this subject that involve assessment data outside of standardized tests written only for the study does not do this and can greatly alter research results. By involving a variety of student groups I will also be considering alternatives to a straight single-gender approach to mathematics at the same time. Regardless of the findings of the study the results will be

useful in determining either an alternate approach to math education for girls or be useful in an extension study about which students seem to do the best in this type of setting.

I am interested in this study for how it can impact not only my own classroom, but those of others. Although I have never experienced single-gender education as a student, I have watched it as an adult teacher. I am interested in trying it out as an educator, though I have not yet had that opportunity myself. I am currently at a school with access to two of those groups described to be studied in my proposal: we offer specific courses for students that are single-gender in the midst of a predominately mixed-gender course load. Studying these students' responses to their math classes would be very feasible for me, as I have already done so in an informal way. It would be more difficult I think to find a single school where all three options take place at the same time, but within a district or neighboring districts would be doable. In the end, finding the best way to educate individual students should always be our goal in education, and this study will set out to work towards that end in a relatively simple, yet carefully orchestrated way.

Appendix A: References/Annotations

Abbot, S. (Apr. 2007). The effects of single-gender classrooms on mathematics achievement within the gifted population. (Doctoral Dissertation, Waldon University, 2007). Retrieved July 30, 2010 from ProQuest:

<http://proquest.umi.com.proxy1.cl.msu.edu/pqdweb?index=29&sid=3&srchmode=1&vinst=PROD&fmt=14&startpage=-1&clientid=3552&vname=PQD&RQT=309&did=1296096221&scaling=FULL&ts=1280524998&vtype=PQD&rqt=309&TS=1280525460&clientId=3552>

This dissertation was used primarily for my perspectives section, as Steven Abbott focused his research on the gifted population. To gain focus and attention on the gifted population, Abbott discusses the social and cognitive differences in these students. Then he outlines the benefits of having a single-gender population in mathematics for these students. Although I thought my research question was quite narrow, having specific constraints that I would study female students at the secondary level in math classes, Abbott went deeper into the subject by focusing on the gifted population. It is nice to have research that discusses many topics and finds out many things, but it is also helpful—more so at times—to have research plunge deeply into a very specific subject matter. Therefore, I found this piece interesting to explore in my research.

Brittmon, T. (Aug. 2008). Single-sex classrooms: Do they impact student absenteeism, academic achievement, and the drop-out rate? (Doctoral Dissertation, Union University, 2008). Retrieved July 30, 2010 from ProQuest: <http://proquest.umi.com/pqdlink?did=1594477231&Fmt=14&VType=PQD&VInst=PROD&RQT=309&VName=PQD&TS=1280580331&clientId=79356>

In her dissertation, Tracy Brittmon gives evidence to show that there is little change in social outcomes and beliefs or desires in math education experienced by girls who are in single-gender classrooms. I used this piece as an alternative view to the one that I intended to find in my hypothesis of study. I thought this was interesting because she was so specific in what she wanted to know about (the three social outcomes described in the title, but still she mentioned the rise in test scores despite the lack of a change in the outcomes it would seem she would have been looking for.

Buske, J. (June 2010). Prince William middle school to try single-sex classes. *Washington Post*. Retrieved from Academic Resources and Research Index: <http://www.washingtonpost.com/wp-dyn/content/article/2010/06/15/AR2010061505183.html>

This is a very specific article discussing a school on the brink of remapping their classroom structures, by offering single-sex classes for the first time this coming fall. As a very current article, the author tries to make the case for why the school is going in this new direction and what gains the school hopes to make through the endeavor. For my focus on the secondary female student, the article contributes information regarding the success of single gender education in recent years at the high school level, thus making the case for why the district might carry single-gender classes down into the

middle school level. This piece cites assessment success for mathematics single-gender classes in my research.

Dachel, J. (Dec. 2009). Single gender classrooms: Information parents need to know to make an informed decision. (Master's Dissertation, University of Wisconsin-Stout, 2009). Retrieved July 30, 2010 from Google Scholar: <http://www.uwstout.edu/static/lib/thesis/2009/2009dachelj.pdf>

This research paper was designed to alert parents to the questions they should ask and the things they should consider about their child's education before having them participate in single-gender classrooms. The research backing the paper comes mainly from interviews with some numerical data. To conduct the research, the author spoke with and corresponded with many parents, teachers, and students and gathered their questions, fears, frustrations, and joys in regards to single-gender education. I felt the information pertaining to how to best teach girls in this setting was valuable, as it spoke directly of certain pedagogical practices to employ.

Dunlap, C. (2002). An examination of gender differences in today's mathematics classrooms: Exploring single-gender mathematics classrooms. (Master's Dissertation, Cedarville University, 2002). Retrieved July 30, 2010 from Ohio Link ETD: <http://etd.ohiolink.edu/send-pdf.cgi/Dunlap%20Celeste%20E.pdf?cedar1033047176>

In this thesis, Dunlap explores the ramification of gender differences in fifth grade students. These students are one year shy of my target age group, the secondary student. Because of this, I felt the study was also applicable, as the students looked at will next become middle school aged students and will continue being affected by their experience whether they continue in single-gender math education or switch to a coed approach. This piece was helpful as the author provided statistical data rather than only qualitative data that are grounded in interpretations of findings. Having numerical statistics is important to back up research and to make one's research and assertions more believable.

Garcia, V. (May 2009). Effects of same gender versus mixed gender instruction on science and social studies achievement, attitudes, and behavior of seventh grade students. (Doctoral Dissertation, Trevecca Nazarene University, 2009). Retrieved July 30, 2010 from Google Scholar: <http://proquest.umi.com.proxy1.cl.msu.edu/pqdweb?index=0&did=1835286891&SrchMode=1&sid=2&Fmt=14&VInst=PROD&VType=PQD&RQT=309&VName=PQD&TS=1280610973&clientId=3552>

Although this dissertation does not specifically address math (it actually is geared towards two other subjects completely), I felt it was useful when considering teaching methods for middle school and other secondary students. The study is focused on seventh grade students and their response to single-gender instruction that is gender specific to the way they learn best. The best point I thought this writing made was when it addressed adversaries to a single-gender system. This article was useful in helping me consider what sort of teaching must take place to be successful; it isn't that girls and boys are merely in separate rooms but that they are actually being taught differently in light of that fact. The author rose to

the occasion when needed to answer some important questions those who are fearful of single-gender education and how it might harm girls, as well as boys.

Gross, J. (Nov. 1993). To help girls keep up – Math class without boys. *New York Times*. Retrieved July 31, 2010 from Google: <http://www.nytimes.com/1993/11/24/technology/to-help-girls-keep-up-math-class-without-boys.html>

This article was pulled from the *Times* archives and was one of the oldest ones I used for research. What I found interesting was the fact that some schools were trying out classes with a single-gender approach for girls before it was really accepted legally to do so—and finding success with it. The gap between girls and boys on standardized tests is acknowledged and then embraced, to show that girls can improve when taught differently. Being that it was a little edgy of a topic for its time, I felt it was important to include what was already being done in the early 1990s alongside all of the current research that made up the majority of my research. I included this information under the assessment portion of my review and used it to highlight early successes for girls in single-gender math classes at the high school level that have the potential to continue or even be greater today.

Gurian, M. & Stevens, K. (Nov. 2004). With boys and girls in mind. *Educational Leadership*, 62, 3. P. 21-26. Retrieved July 27, 2010 from Google Scholar: http://www.ascd.org/authors/ed_lead/el200411_gurian.html

This article presented its views primarily from a scientific standpoint, which differed from several others that seemed to focus more on social aspects. Although it wasn't discussing math education specifically, the authors described the basis for gender differences and provided suggestions for enhancing learning on both sides, which contributes to the pedagogy aspect of my report. The article also made the case for why girls tend to do better in the traditional school setting and how we have seen the gender gap grow over the years since statistics on this topic were starting to be kept. The main point is to show how boys are behind girls in learning and why, as well as to improve the quality of education for both.

Ma, X. (May 2008). Within-school gender gaps in reading, mathematics, and science literacy. *Comparative Education Review*, 52, 3. P.437-456. Retrieved July 27, 2010 from Chicago Journals via Eric: <http://www.journals.uchicago.edu/doi/abs/10.1086/588762>

This article was one of the few that I found that had sections and studies described that were specifically geared towards math in relation to single-gender education. The author conducted research in math as well as reading and science classes. In addition to giving new perspectives about how different countries have responded to gender differences, the article outlines data with specific figures that are easily understood. The data is not specific to the United States nor does it favor girls and the author admits outright that there are many variables which affect results during testing—outside of just gender. Because of this, I thought the article and assessment results seemed more unbiased and more honest than some other pieces of research I came across when searching.

Medina, J. (Mar. 2009). Boys and girls together, taught separately, in public school. *The New York Times*. Retrieved July 30, 2010 from Academic References and Research Index: <http://www.nytimes.com/2009/03/11/education/11gender.html>

I thought this article was interesting because it showed the effects of single-gender education on girls through the eyes of boys and those who teach them. Being from the *Times*, this article would have had more readers than many other more "scholarly" pieces. Evidence is primarily shown through interview with teachers and students, with results being more candid than numerical data. The part that I was interested in and used for my study focused on behavioral response and interest in the subject taught as result in having a single-gender approach in the classroom.

Meyer, J. (Dec. 2009). "FOR GIRLS ONLY State's first single-sex public school will be attempt to lift achievement." *Denver Post*. Retrieved July 30, 2010 from General Reference Center Gold: http://find.galegroup.com/gtx/infomark.do?&contentSet=IAC-Documents&type=retrieve&tabID=T004&prodId=GRGM&docId=CJ215813028&source=gale&srcprod=GRGM&userGroupName=lom_accessmich&version=1.0

The only pieces of this article I used directly in my paper were statistical data pertaining to the history of single-gender education. However, I did gain perspective and was influenced in thought about what single-gender classes mean to students in them and to parents who have them children participate in them. The article seems to show how Colorado's new school will be a breath of fresh air for some students, who desperately need a place to learn that is free from gender stereotyping and the pressures of existing so closely with the other sex. The new school is expected to be a positive place for girls who will be learning not only math without male students, but all of their subjects.

Meyer, P. (2008). Learning separately: the case for single-sex schools. *Education Next*, 8, 1. P. 10(12). Retrieved July 30, 2010, from Educator's Reference Complete via Gale: http://find.galegroup.com/gtx/start.do?prodID=PROF&userGroupName=lom_accessmich

Despite the seemingly biased title, this article was helpful in my pursuit of unbiased research and perspectives. The author pointed out significant arguments from both sides of the argument, as well as from somewhere in the middle. I appreciated the thoroughness of attention given to the background of the issue, as well as the supplemental information about other related issues and outcomes. This article gave me a good understanding and starting ground for my research and supported several of my assumptions and beliefs without needing to completely support my research question or hypothesis.

Penner, A.M., & Paret, M. (2008). Gender differences in mathematics achievement: Exploring the early grades and the extremes. *Social Science Research*, 37. P. 239-253. Retrieved July 27, 2010, from Science Direct: <http://www.sciencedirect.com>

Although my research question focused primarily on secondary students, I felt it was important to consider what is happening in the academic lives of students in earlier grades as well. This article

discussed mostly elementary age students. It also went on to show how those same gender differences were no less present later in life and how they continued to affect career and other life choices. Much of the research findings were written in a mathematical language even going over my head as a math teacher, but the summarizations and explanations helped to keep the article useful and relevant to the topic.

Science Daily. (Apr. 2008). *Keep boys and girls together in the classroom to optimize learning, research suggests*. Retrieved from <http://www.sciencedaily.com/releases/2008/04/080411150856.htm>

This online article is an adaptation of a previous piece by Tel Aviv University, which reported findings that were the opposite of much of the other research I read. The argument is that having girls and boys together in the classroom actually encourages each of the successes to behave better and achieve greater. I found this perspective interesting, yet the research in this particular article seemed somewhat shallow and the proof in numbers did not appear. Guesses are made as to why this might be so, but nothing definite is discussed. I used the article, though, because it made me really start thinking about why we teach both genders together in the first place, and what kind of learning opportunities—even if they are merely social—might be missed by separating girls out even just for math classes. This is different than I would have previously thought about the issue, and it makes the matter much less black and white.

Weil, E. (Mar. 2008). Teaching boys and girls separately. *The New York Times*. Retrieved July 30, 2010 from Academic References and Research Index: http://www.nytimes.com/2008/03/02/magazine/02sex3-t.html?_r=1&pagewanted=all

When reading this article, I got the sense that it was wrapping up the argument in my mind for whether or not girls and boys should be separated in schools. The author makes the point that gender issues don't have to be issues at all; but if they are, having the choice to maintain single-gender classes for students can be a positive thing. I used this article to bridge many ideas I had and to gain a new perspective on why each side was, in fact, right for their own purposes at times—even if they differed. The article seems to call more for choice to allow individuals to be taught in whatever manner is the best fit for them, which is ultimately the goal of education as I see it.

Appendix B: Project Revision Summary Sheet

SUGGESTIONS: Focus & Rationale

- 1) “When you say “effects”, are you speaking mainly of students’ understanding of math. Are you also interested in their interest in the class and subject matter?”
 - ➔ Since my first turn-in of the F&R, I modified my question from “What is the effect...” to “What are the effects...” because I feel this is more open-ended and allowing for discovery through the study. Also, in the first sentence of my rationale, I have clarified the three issues I am most concerned with: “perception of abilities, interest in learning, and academic success.” I see the first two as going together and the third as a separate matter, questioning whether or not skills actually improved.
- 2) “What are your hunches on why the mix of the class makes a difference? Are there ways you can gather some data on these hunches?”
 - ➔ I think yes, and tried to expand on this in the last few sentences of the second paragraph of my rationale.
- 3) “Do you think it makes a difference that these are math classes? Would you see the same effects in an English class, for example?”
 - ➔ I tried to put a great deal of emphasis on math classes because I have seen in research I’ve studied how easy it is to become too generalized in discussion and detract from supporting the actual research question related to math. I did mention Physical Education classes as an example, but chose not to expand on this or other subject matter outside of math.

SUGGESTIONS: Literature Review

- 1) “In the Pedagogy section, put greater emphasis on describing a variety of practices related to single-gender education. What are the various ways that single-gender education has been put into practice? Single-gender schools, classes, small groups, etc. Also, try to learn more about what happens in these classes – is the actual teaching different? Report what was tried and the results of these practices, if possible. This is intended to help you make an informed choice about pedagogical intervention you might try for your own study.”
 - ➔ I went back to some of my research pieces to uncover and describe more information about what methods of teaching were tried specifically and how the researchers believe classrooms should be run in a girls-only environment. Some additions were made to describe this (Dachel study in paragraph 4, Abbott study in paragraph 5).
- 2) “In the Assessment section, I want you to learn more about how researchers assessed the effects you’re interested in – e.g., achievement, confidence, self-image, etc. Describe the methods and data-collection instruments used in the studies, rather than the findings of the studies. This is intended to help you make an informed choice about the assessment methods for your own study.”

- ➔ I felt like I had touched on this in several of my descriptions, but have tried to modify to be clearer and expand where I could (i.e. Dunlap study in paragraph 4, Brittmon study in paragraph 5).

SUGGESTIONS: Research Design

- 1) "I'd like you to be more specific about what kinds of information you'd like to get from your students and the ways you'll get this information."
 - ➔ I tried to "beef up" the Procedures and Assessments portions of the design by including more information about the kinds of questions that would be asked of the students and the format for how they would be asked. I also included a section on what I am hoping to "get" from the study in the Assessments paragraph.
- 2) "Also, I'd really like students to come up with designs that they can carry out. Is this a feasible design for you?"
 - ➔ For the most part, I believe so. In the end of the Design Rationale section, I have discussed my experience with and access to single-gender math experiences for middle school girls as well as my interest in exploring them further. From discussing with my colleagues through the discussion boards, I know that there are schools in Michigan who are already moved in the all-girls direction, as well as others around the world. Therefore, I do not think it would be difficult to carry my study out, though some travel would be required to conduct all interviews in person myself to maintain consistency. Also, schools would need to be carefully selected in groups by those which would administer the same standardized tests; but again, I do not believe this would be difficult to do.