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Demography as destiny: the role of parental connoisseurship and mathematics course taking patterns among high school students

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DEMOGRAPHY AS DESTINY

THE ROLE OF PARENTAL CONNOISSEURSHIP AND MATHEMATICS COURSE TAKING PATTERNS AMONG HIGH SCHOOL STUDENTS

by

Katherine Marie Degner

An Abstract

Of a thesis submitted in partial fulfillment
of the requirements for the Doctor of
Philosophy degree in Teaching and Learning
in the Graduate College of
The University of Iowa

May 2012

Thesis Supervisor: Professor Peter Hlebowitsh

ABSTRACT

This study uses data from the National Center of Education Statistics (NCES) High School Longitudinal Study of 2009 (HLS:09). Parent responses to the Parent Involvement survey, given as part of the NCES study were considered, along with their child's socio-economic status and self-reported level of mathematics course enrollment during their 9th grade year of high school

The purpose of this study is to identify parent behaviors that result in their child enrolling in upper level mathematics coursework in high school, regardless of race or ethnicity. Seven 2-factor ANOVA tests were conducted to determine interaction effects between types of parent behaviors and level of 9th grade mathematics course enrollment.

The interaction effect between passive parental connoisseurship and socio-economic status was found to be significant. The main effect of socio-economic status, as well as school choice, direct parental connoisseurship, indirect parental connoisseurship, and passive indirect parental connoisseurship were also found to be significant. As expected the main effect of a student's socio-economic status was also significant, in terms of level of 9th grade mathematics course enrollment.

The findings from this study suggest that when students from lower socio-economic background are grouped homogenously in school related setting and out of school experiences, the level of mathematics course enrollment is lower than their middle and upper class counterparts.

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PH.D. THESIS

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It always seems impossible until it's done.

Nelson Mandela
A Long Walk to Freedom

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TABLE OF CONTENTS

LIST OF TABLES

Table

LIST OF FIGURES

Figure

CHAPTER I: INTRODUCTION TO THE PROBLEM

Education is a fundamental solution to poverty.

Governor Kathleen Blanco

A notable characteristic of schooling in the United States is that public school children are able to take different courses, based on their abilities and interests. Although this may exist minimally in elementary and middle school, coursework in the American high school is starkly differentiated through the use of curriculum tracks. Students decide to self-enroll in some courses, based on interest level in a particular topic, such as foreign language, shop classes, or fine arts classes. But in ability-based core academic areas enrollment sometimes requires teacher recommendations, and evidence of previous performance in school (and even standardized test scores) (Kelly, 2007; Oakes, 2005). This practice of placing students into varying levels of core content areas, or tracking students, could be interpreted as having some roots in the elementary school through the use of ability-based reading groups. But the reality is that tracking takes its main forms in the middle school, where the school experience is marked by between class groupings (Gamoran, 2000).

The idea of tracking students into varying levels of core academic areas has not been without criticism. Oakes (2005) identified and described the problem with curriculum tracking. She found that students in lower tracked classes were typically taught with less experienced teachers, in larger classes, and in classes with lower academic expectations than those enrolled in higher tracked classes. This disparity is problematic for a variety of reasons, but perhaps the most troubling feature has to do with

the lower quality experiences offered in the lower tracked setting and the disproportionate representation of low socio-economic and minority children in these lower tracks.

In fact, Caro, McDonald, and Willims (2009) identified the disparity between the academic experiences of low socio-economic and middle and upper class students as a cumulative advantage process. They claim that the cumulative advantage experienced by upper and middle class students is a product of a curriculum that allows for differential, exposure rates to higher academic and high cognitive opportunities. When children from higher economic backgrounds are continually exposed to these experiences, both in and out of school, the academic and social benefits continue to accumulate. As children acquire more and more of these assets the academic achievement gap continues to widen between children of various economic backgrounds. The rate at which children accumulate these academic and social assets when placed in higher tracked classes, continues to accelerate throughout their K – 12 schooling experience, while students placed in lower academic tracks show steady growth from year-to-year. Thus, not only is there an achievement gap between these two groups of students, the gap continues to grow wider and wider the longer children are in school.

Given these documented problems, what influence do parents, teachers, and administrators have in placing low socio-economic status students in to lower tracked classes? Lareau (1987) and Condron (2007) claim that course enrollment is shaped by the "cultural capital" students bring to school. Their theory is that students from upper and middle class families possess more cultural capital to negotiate placement to the advantage of their children. They see this as part and parcel of an upbringing strategy

that includes extended education in the home and extra-school experiences off the school site.

Students who exhibit the characteristics of working hard, following directions, and completing schoolwork in a timely manner are more likely to be placed in higher skill groups, even if their skills are lacking in one way or another (Condron, 2007). Lareau characterizes the development of these types of pro-school behaviors as a concerted cultivation, in which parents enroll their students in out of school academic experiences, such as music lessons or tutoring, encourage their students to participate in athletic clubs, and teach students to interact appropriately with other adults. Lareau maintains that concerted cultivation only occurs in upper- and middle-class families, regardless of race (Lareau, 2002).

In her book *Unequal Childhoods*, Lareau (2004) identified the ways that some parents were able to navigate the day-to-day operations of the school, to the advantage of their child. Their navigation skills underscore the type of parental involvement that shapes student school experiences. Students with parents who are familiar with the workings of a school and comfortable with challenging decisions made by the teachers and administrators are more likely to receive less harsh punishments when rules have been broken at school. They are also more likely to be contacted on issues of academic and social progress at school. According to Lareau (1987), aspects of cultural capital are used by teachers when assigning students to courses in early grades. Because some students with significant cultural capital come to school with pro-school behaviors, teachers are more likely to give such students the benefit of the doubt if they are lacking in a particular skill set.

Although parent involvement is not unique to middle and upper class families, parents from economically advantaged backgrounds tend to have and use more of it than parents from low socio-economic backgrounds. Bidwell and Friedkin (1988) identified three ways to explain the phenomenon:

1. The education of middle-and upper-class families might promote the development of attitudes and traits that match the demand of negotiating the school environment
2. Upper class families might simply have better learning resources
3. Upper class students enjoy direct favoritism in the school setting.

Similarly, Crosnoe, Mistry, and Elder (2002) found that when students from low socio-economic settings were placed in advantaged school environments, they were more likely to pursue an education after high school. However, they also found that many parents of low socio-economic students thought that the chances of their students attending college were low, either because of lack of financial stability or from personal experience. Lower income parents often have a less than happy history of school participation; they sometimes have other essential tasks, such as working or babysitting to help support family life. As a result, they reported more frequently that involvement in the school environment as a less than critical endeavor.

Lareau (2004) offers another explanation for low socio-economic parent's reluctance to become involved in their student's life at school. She maintains that parents from low-income families believe that parental involvement is not necessary because schooling is best left to the teacher and the school. Any questioning of the school or the teacher is considered disrespectful. Additionally, parents from low-income families may

approach school officials with trepidation, because the school and its officials are seen as extensions of the state, which may judge their parenting negatively.

In response to this criticism some high schools are allowing students to self select their high school courses in core academic subjects (Oakes, 2005; Tyson, 2011). Restrictions on honors and Advanced Placement courses are being lifted, seemingly allowing any student willing to put forth the effort to take their desired course (Tyson, 2011). In essence, this practice is removing the responsibility of course-placement from that of the school and placing it onto that of the adolescent student. Despite this, recent national data, as well as independent qualitative studies, show that low socio-economic students and minorities enroll in rigorous coursework less frequently than their white, middle and upper class counterparts (Bozick & Ingels 2008; Caro, McDonald, Willims, 2009; Oakes, 2005; Tyson, 2011). Additionally, student interviews and experience in the school also demonstrate that students do not feel as though they belong in these courses, even if they have the academic ability to do the coursework (Oakes, 1992; Tyson, 2011).

Ryan (2001) describes enrolling in advanced academic courses in the context of peer group influences. She found that peer group influences played a major role in middle school students' decision-making process both about the usefulness of schooling and in terms of motivation. Similarly, Riegle-Crumb, Farkas, and Muller (2006) illustrate the relationship between friends and advanced course taking by saying,

> Friends can offer help with homework or impart information about the best teachers or the most important classes to take to get into college.
>
> (p. 207).

By allowing students to self-select in to advanced course work, schools are expecting students from varying peer groups to in-effect disregard the influences of their

friends to enroll in advanced course taking. Both Ryan's (2001) and Riegle-Crumb, Farkas, and Muller's (2006) findings assert that this is not likely to occur among adolescents.

Course Selection in Mathematics

Many national studies highlight the importance of mathematics course-taking in high school as it relates to persistence toward degree attainment in college, future salary potential, and high school achievement (Adelman, 2006; Sadler & Tai, 2007). Because mathematics course selection is so strongly correlated to these aspects of post-secondary success, the disparity between white and minority students and low socio-economic and middle and upper class student course-taking patterns is especially alarming. It appears as though students are selecting out of these courses, and by doing so they are selecting themselves out of key opportunities for post-secondary success.

The disparity in student course selection is perhaps the most notable in advanced mathematics course taking among students. Because mathematics is taught sequentially, some of this may be due to the fact that students cannot elect to enroll in advanced mathematics courses, without the appropriate prerequisites. But the sequential nature of mathematics course-taking shows how important it is to consider curriculum tracking decisions when they are first made. When students are tracked according to their mathematics ability, either in late elementary school or middle school, they have difficultly switching tracks, as this could mean needing to skip a mathematics course altogether. Simply allowing students to select the mathematics courses as they please may not be an aggressive enough approach, especially when these decisions are first made in the earlier grades.

Caro, McDonald, and Willms (2009) found that while an achievement gap exists between the upper quartile and lower quartile of students, according to their socio-economic status, this difference doubles in mathematics achievement by age 12 (about halfway through their formal K – 12 schooling) and continues to widen until graduation. This difference in mathematics achievement likely becomes more pronounced because of exposure opportunities to advanced mathematics course-work, peer group influences, and because of student attitudes toward schooling, and advanced mathematics course-taking.

Goldthorp (1996) found that many older students become aware of the varying levels of socio-economic status and decide that working hard in school, may not be worth it. Berryman (1987) describes this situation saying,

> They [high school students] seem to work out notions of their basic futures and of the trajectories relevant to them, electing into or out of advanced mathematics. (p.7).

Additionally, many times the rationale for persisting in advanced mathematics coursework in high school is a matter of what one might need in the future – needing mathematics for college, or some other endeavor that students (or parents and teachers) do not envision for themselves. Thus, the idea that upper level mathematics courses are not for them prevails (Chazan, 2000). And mathematics teachers could most likely be further exacerbating the problem, because as students they did not have similar experiences in the coursework of mathematics curriculum. Teachers are less likely to identify this fact, than are the students (Chazan, 2000).

The importance of taking Algebra in 8th grade, as it relates to high school mathematics achievement and attainment seems profoundly important. Smith (1996) found that students who were not enrolled in Algebra early in their high school career

were less likely to persist in the areas of advanced mathematics throughout high school and into college. He also found that students from low economic backgrounds are enrolled in 8th grade Algebra less frequently than any other subgroup (other than special education) in the school.

Further, students from low socio-economic backgrounds are less likely to have conversations with teachers and parents about their mathematics course selection in high school. This type of teacher/student and parent/student interaction has shown to positively correlate with advanced course taking in mathematics (Crosnoe & Schneider, 2010).

Wang (2004) identified parental behaviors that resulted in higher test results on the 2003 TIMSS. In particular, parents who had high expectations for their children, provided a workspace, books and computers in the home, and viewed themselves as authoritative with regard to school work had children who performed better on the TIMSS when compared to the rest of the tested population. The behaviors described by Wang (2004), align with the cultural capital described by Lamont and Lareau (1998) and Condron (2007).

Purpose of the Study

The purpose of this study is to identify factors that may explain the enrollment patterns in mathematics curriculum tracks, especially as they affect children from lower socio-economic settings. I will use the data obtained from the 2009 High School Transcript Study (Ingels, Pratt, Herget, Burns, Dever, Ottem, Rogers, Jin, & Leinwand, 2011) to identify parent behaviors that correlate with enrollment in upper level mathematics courses. My hypothesis is that parents, whose parenting behaviors can be

characterized as pro-school (what I also call parental connoisseurs) will be more likely to have children who both enroll in upper level mathematics course work and persist in mathematics coursework throughout their high school career, regardless of race or socio-economic status. Additionally, I ask whether, middle and upper class parents are more likely to engage in certain forms of parental connoisseurship, thus offering an explanation for their particular higher enrollment in upper level mathematics courses.

For this study I use the work of Lareau (2002), Coleman (1987), and Hill, Castelino, Lansford, Nowlin, Dodge, Bates, and Pettit (2004) to define parental connoisseurship as a particular type of parental involvement. I define parental connoisseurship to be a parent's work with schools, their communities, social ties, and with their children and other family members to benefit their children's educational outcomes and future success. Examples of parental connoisseurship are volunteering at school, parent-teacher contact, involvement in academic-related activities at home, the use of personal social relationships, and the quality of parent-teacher relationships. It is the combination of these actions and interactions between parents, society, school, and child that I have defined as parental connoisseurship.

My research questions for this study are:

1. What relationship does parental connoisseurship have with the mathematics course-taking decisions of school children?
2. Do middle and upper class parents, regardless of race or ethnicity, engage in connoisseurship behaviors more than their lower and working class counterparts?
3. Is there a profile of characteristics to a particular form of connoisseurship that explain the mathematics course taking decisions of school children?

I will answer these research questions by using data from the High School Longitudinal Study of 2009 (HSLS: 2009), in particular the parent responses on the parent questionnaire and the student questionnaire to determine freshman year mathematics course enrollment.

CHAPTER II: LITERATURE REVIEW

> It would be nice if the poor were to get even half of the money that is spent in studying them.
>
> Bill Vaughan

Tracking

The practice of sorting students by perceived or measured abilities in particular subject areas in schools is used widely across both public and private sectors (for example Broaded, 1997; Lucas, 1999, Muijs & Dunne, 2010; Oakes, 2005; Schofield, 2010). In the United States, the practice of the school placing students in particular curricular tracks began almost in tandem with the effort to expand the school and retain students through to high school graduation (Lucas, 1999; Oakes, 2005). Initially, students were placed in varying academic tracks, based on the idea of social Darwinism, advanced notably by G. Stanley Hall. The idea was that particular students were predisposed to learning, in ways that other students were not. In particular, the students of parents from already educated backgrounds were believed to be more likely to benefit from advanced studies, as indicated by their lineage. IQ testing was also used to place students into academic tracks, to ensure that those students who were bright enough could advance themselves in ways that improved the society. Similarly, IQ testing and lineage was used as a way to sort and slot students into job categories, such as day laborers, and factory workers. Such students were not expected to learn a high caliber academic curriculum (Lucas, 1999). Lucas describes the purpose of tracking students by noting that,

> Tracking was designed not only to slot students in to positions in the economy, but also to encourage the individual student to resign himself or herself to this lot […] In other words, tracking was designed to sort and pacify students.
> (p. 11).

This idea of sorting and placing students according to their perceived abilities, and in turn purpose for serving the American society, was common practice until the late 1960's and early 1970's. During this time school placement policies underwent what Lucas (1999) identifies as an unremarked change in tracking policies. That is, instead of students being placed in the "college preparatory" or "general" tracks, students were able to move freely between tracks, based on their academic areas of strength. For example, a person with interest or talent in the area of mathematics, may enroll in college preparatory level mathematics and science classes, but may only enroll in general English and writing classes. Before the unremarked tracking change in American schools this type of discrepancy track placement (Lucas, 1999), was essentially non-existent.

The change in tracking practices came about, in part, because of evidence that students from low income, minority, or immigrant families were being disproportionately placed in the "general" academic high school tracks, while upper and middle class white students were being over represented in college preparatory tracks. Even after the unremarked revolution in tracking, studies suggest that problems with tracking continue to exist. In her book *Keeping Track* (2005), Oakes identifies the differences in teacher practice, classroom expectations, and opportunity to learn between high and low academic tracks in various curricular areas. Although her writing may be considered a landmark investigation in to the disparities in academic course placement between high and low tracks, many other scholars have followed in her footsteps, uncovering similar disparities in academic track placement for students (for example, Ballon, 2008; Chiu,

Beru, Watley, Wubu, Simson, Kessinger, Rivera, Schmidlein, Wigfield, 2008; Gamoran, 1992; Kelly, 2007).

Reasons for tracking

Although much evidence exists, speaking to problems with tracking students in the school curriculum, it nevertheless persists in the majority of American middle and high schools in the United States. Reasons are varied and include; culturally accepted norms (Lareau, 2002; Lucas, 1999; Oakes, 2005) and teacher and parent beliefs that sorting students is the only way to advance the learning of the brightest students, while also meeting the needs of the struggling students (Hallam and Ireson, 2005; Harris, 2010; Marks, Cresswell, Ainley, 2006; Muijs and Dunne, 2010).

In her article, *Can Tracking Research Inform Practice*? Oakes (1992) identifies three reasons, which interact with each other to explain why schools continue to track. Although much evidence shows that the practice of tracking students may actually emphasize, rather than, eliminate the difference between social class differences. Oakes believes that schools continue to track students because; teachers and school administrators believe that student variation in skills and aptitude can only be handled through between class grouping; schools must fulfill the social purpose of transmitting the knowledge and value of students' cultures, while also preparing them to be productive contributors to the work force; and schools can best accommodate the differences in social purpose by separating students according to their ability level and likely occupational futures.

Similarly Anasalone (2010) lists four beliefs that she asserts are held by school officials, teachers and parents that reinforce the practice of tracking students. First, she

states that many people believe that, contrary to research evidence, all children learn better if they are grouped homogeneously with students of similar ability (this is similar to the third reason outlined by Oakes (1992) and Muijs and Dunne (2010)). Second, many parents and teachers believe that tracking is fair, accurate, and enhances equity in the educational process; third, educators often believe that students will suffer emotionally if they are placed in the same classroom with more able children, and fourth teachers prefer tracked classes because they limit the wide range of academic diversity in the class and make teaching functionally easier. It is important to note that many of the reasons for tracking outlined by both Oakes (1992) and Ansalone (2010) are not supported in the current research literature. (The one exception may be the fourth belief outlined by Ansalone). However, these beliefs continue to both persist and impact educational policy implemented in many American school districts.

Along these same lines, Hallam and Ireson (2005) conducted a study of teachers in England, in which teachers teaching both tracked (or set) and mixed ability classes were surveyed. The results of the survey showed that teachers believed that teaching is easier when teaching tracked classes. However, there was not a consensus among the teachers surveyed that only very strong teachers could teach mixed ability classes. The results from this survey indicated that while teachers prefer to teach tracked classes, they acknowledge that teaching mixed ability classes is possible. Additionally, the idea that teaching tracked classes is easier could be due to the fact that teachers are accustomed to teaching these types of classes, thus making it more difficult for teachers to break the habituated cultural norms of the school outlined by Oakes (2005) and Coleman (1975).

Hallam and Ireson (2005) also found that teachers believe that lower ability students require a different style of teaching in order to learn the material. This perceived need for a difference in teaching styles made it seem easier for the teachers to divide students according to their perceived ability in particular academic subjects. The teachers in this study also mirrored the findings of Oakes (2005) and Ansalone (2010), both that ability grouping restricted some pupils' opportunities. Teachers believed that having mixed ability classes did not serve the needs of high ability students, because they were being denied access to the high quality curriculum they needed in order to meet their high academic needs (Hallam & Ireson, 2005).

Problems with Tracking

Although there are a variety of reasons schools decide to track, there little evidence showing that tracking actually helps with student achievement in schools, when comparing tracked to non-tracked academic subject areas or schools. In fact, Gamoran (1992) found that the difference in achievement between tracked and non-tracked schools was essentially non-existent. He asserts that this is the case because high achieving students in tracked schools perform slightly better than their comparable counterparts in non-tracked schools, but low ability students perform much better in non-tracked schools. In other words, the standard deviation of achievement scores between low ability and high ability students in tracked schools is larger than that of low ability and high ability students in non-tracked schools. Further, Gamoran (1992) also found that the difference in achievement between students placed in high ability tracks, compared to students dropping out of high school after the tenth grade is smaller than the difference in achievement between students placed in high ability tracks, compared to students still

enrolled in high school, but placed in low ability tracks. He accounts for this finding by hypothesizing that students who drop out of school are required to use higher order thinking skills for problem solving in their day-to-day interactions, either as caretakers of a family member or as an employee at their place of work. He contends that these types of genuine experiences, while less academic then the material students are being exposed to in higher academic tracks, is actually more academic and meaningful then the material students are being exposed to in the lowest academic tracks in a particular school (Burris, Wiley, Welner, & Murphy, 2008; Gamoran, 1992). Muijs and Dunne (2010) had finding similar to Gamoran (1992) when comparing tracked and non-tracked mathematics courses. Through their survey of literature related to mathematics and tracking in Ireland, they found small positive effects in tracked versus non-tracked classes. They assert that this is due to the fact that students in tracked classes experience a wider achievement gap, compared to students in non-tracked mathematics classes who perform more similarly.

There are a variety of reasons this disparity in achievement between high and low tracked students may take place. One explanation is that high ability students are placed in higher tracked classes because they are more prepared for the material. Thus, if high ability students were more capable of learning advanced science, for example, we would expect that they would perform better than their lower tracked counterparts just due to natural ability. However, Gamoran (1992) also found that when comparing students in remedial classes to students from similar backgrounds and initial achievement measurements who are in untracked classes the students in untracked classes performed better than the students who were tracked. Similarly, Schoefield (2010) found that school

systems with more tracks experience a larger achievement gap between students from different backgrounds when compared with school systems with fewer academic tracks. This phenomenon is labeled by Lee and Bryk (1988) as the "Catholic School Effect." It is so named, because typically Catholic schools have fewer track selections than their public school counterparts and the variation in achievement across students of different backgrounds is smaller. (Lee & Bryk, 1988; Lee, Chow-Hoy, Burkam, Geverdt, Smerdon, 1998). Similarly, in Kelly's (2007) analysis of tracking in the North Carolina public school system, he found that low-track students have the greatest opportunity to learn in schools with a balanced proportion of high and low tracked classes. Willms (2003) finds that when school children are segregated, whether it be between schools or within schools (by way of tracking), there is what he refers to as a "creaming" effect. That is students from a higher socio-economic background are slotted into selective schools or tracks, leaving children from disadvantaged backgrounds in lower tracked classes or schools. The result of this "creaming" of students is that students from higher socio-economic status backgrounds fare better in schools, and disadvantaged students fare much worse, in terms of academic achievement.

Part of the reason the practice of tracking students is troubling is because the disparity in school achievement tends to effect minority students and students from low socio-economic backgrounds in greater proportion, than white middle and upper class students. This could be because students from disadvantaged backgrounds tend to be placed in the remedial academic tracks more frequently than other students (Akos, Lambie, Milsom, Gilbert, 2007; Caro, McDonald, Planck, Willms, 2009; Kelly, 2007; Lareau, 2000; Muijs & Dunne, 2010; Oakes, 2005; Tyson, 2011). In fact, Schofield

(2010) asserts that when a large proportion of students are placed in the lower academic track, the relationship between socio-economic status and achievement is strong. When looking at racial differences in mathematics track assignment, Ballon (2008) and Borman and Dowling (2010) argue that school compositional characteristics have a larger impact on student achievement, then does track placement. In fact, Borman and Dowling (2010) found that school compositional effects explained more academic variability among black students than their white counterparts. The more diverse the student population is in a school, the larger the difference in achievement between high and low tracked students tends to be. Lucas and Berhends (2002), refer to this type of tracking as "de-facto" tracking. In other words, although students are not placed in to high and low tracked classes, because of the variety of coursework offered in each curricular area students track themselves in to high and low ability classes according to their race and socio-economic class. Lucas and Berhends (2002) also found that de-facto tracking is more common in public high schools with a large proportion of minority and poor students. In fact, low socio-economic students who attend poor schools are more likely to receive higher track placements, when compared to low socio-economic students attending schools with diverse socio-economic backgrounds (Caro, Lenkeit, Lehmann, Schwippert, 2009; Borman and Dowling (2010)). Kelly (2007) found that when black students attended schools in which they were the minority they were disproportionately assigned to lower academic tracks, than their white counterparts. Similarly, Lee and Bryk (1988) found that too many choices among academic tracks highlight social differences in schools. They argue this likely happens because information about the consequences course selection is not equally available to all students. This has lead many scholars to

assert that tracking is actually being used as a way to socially reproduce a student's role in society (Anasalone, 2010; Burris, Wiley, Welner, Murphy, 2008; Crosnoe, Schneider, 2010; Gamoran, 1987; Gamoran, 1992; Marks, Cresswell, Ainley, 2006; Muijs and Dunne, 2010; Schofield, 2010).

There are essentially two ways students may be placed in academic tracks; first, the school selects the academic track for them or second, the student may select the academic track they wish to pursue themselves. Kelly (2007) found that there is not a uniform method schools use to place students into tracks. He also found that while there may not be uniformity across or within school districts for track placement, the highest tracks of English and mathematics tended to be the most restrictive, in terms of allowing students to enroll in the courses. Similarly, Muijs and Dunne (2010) also found that in schools where administrators reported they used standardized test scores for track placement, there were large overlaps between achievement scores across upper and lower tracks. Further, they found that prior school performance in both English and mathematics were the best indicators for track placement, and in fact high achievement in mathematics coursework was a predictor for being recommended into a higher English track even when achievement scores for other students in English were higher. Crosnoe and Schneider (2010) also noted that through their analysis of students' transcripts and background information available through the 1988 National High School Transcript Study, when low and high socio-economic students had the same observed skill set in middle school the students from high socio-economic status backgrounds started off high school at a higher curricular level than their lower socio-economic status counterparts.

Although academic performance may be one indicator for track placement, many schools reported that they use a variety of factors when determining a students' track placement. Lee and Bryk (1988) found that school administrators reported they used both academic and disciplinary performance records, as well as, teacher recommendations from junior high school to determine high school track placement. Lareau (2002) notes that the practice of using student behavior records for track placement is problematic, because students from low socio-economic status backgrounds tend to have more behavior problems in school, and the behavior problems do not indicate a student's skill level in a particular subject area. Kelly (2007) also found that subjective measures were used to determine high school track placement including high level of self-motivation, inquisitive mind, and high level of oral communication skills, as determined by the students' previous teachers. Similarly, Oakes, Gamoran, and Page (1992) found that students are frequently divided into tracks according to measured or perceived performance in school. They argue that because school performance is related to social inequality outside the school, such placements exacerbate separation of students from difference racial, ethnic, and social backgrounds.

One of the widely accepted theories about track placement by school officials is that students are placed in academic tracks based on immeasurable character traits such as work ethic, parental involvement, and behavior. The collection of these types of pro-school behaviors has been labeled as "cultural capital." (Bourdieu, 1977; Lamont and Lareau, 1988; Muijs and Dunne, 2010). Lamont and Lareau (1988) describe this relationship between character traits and track placement by saying,

> schools are not socially neutral institutions but reflect the experiences of the dominant class, children from this class enter school with key social and cultural

> cues, while working class and lower class students must acquire the knowledge and skills to negotiate their educational experience after they enter school.
>
> (p.13)

Typically, students from middle and upper class backgrounds tend to possess more of this capital, thus resulting in students from these backgrounds being placed in higher academic tracks with more frequency than their lower class counterparts. Placing students in academic tracks based on pro-school behaviors may be more common in early elementary grades, when there are not sufficient academic records or behavior records in place to aid in track placement of elementary students. Many times these early course assignments continue to follow students throughout their school experience, because much of the track placement recommendations in middle and high school are based on earlier school performance (Ballon, 2008; Hallam & Ireson, 2007; Tyson, 2011). Condron (2007) depicts this process with the following graphic:

Figure 1.Factors Used in Student Track Placement.

Source: Condron, D.J. (Feb., 2007). Stratification and educational sorting: Explaining ascriptive inequalities in early childhood reading group placement. *Social Problems. 54(1)*.

In this model, Condron illustrates what he identifies as the three major factors that play in to the decision-making process when placing very young children in ability groups. Because some students come to school with pro-school behaviors, teachers are more likely to give low achieving students with cultural capital the benefit of the doubt when they are lacking in a particular skill set. Students who exhibit the characteristics of working hard, following directions, and completing schoolwork in a timely manner are more likely to be placed in higher skill groups, even if their skills are lacking in one way or another.

Condron (2007) found that students are also placed in tracks based on the school's perceived parental involvement in school issues, the family's educational valuation, and the cultural fit between the school and the child. In fact, Caro, Lenkeit, Lehmann, Schwippert (2009) found that in order for students from lower socio-economic status backgrounds to be recommended for an academic track, they had to, on average, reach a higher level of achievement than those from more advantaged backgrounds. Similarly, Burris and Welner (2005) report that a highly proficient student from a low socio-economic status background has only a 50-50 chance of being placed in a high track class. Because of the role teachers and school counselors play in the course selection process of students, Tyson (2011) refers to school officials as the "gatekeepers," to high school course enrollment. In her observation of six high schools, and the feeder middle schools in North Carolina, she found that teachers and school counselors have a profound influence on the courses students take in high school. In some cases, the school officials had the final word on freshman course placement. In other cases, even when recommendations from school officials did not have to be followed, Tyson (2011) found

that most students she interviewed were reluctant to override the recommendations of their teachers and high school counselors.

In school settings where students and parents are allowed to select the academic tracks students pursue there is still a large proportion of students from low socio-economic status backgrounds choosing to enroll in lower academic tracks. Lee and Bryk (1988) hypothesize that this phenomenon may still be occurring because disadvantaged and minority students have less access to guidance counseling in their high schools. These are students who are likely to need advice about the future implications of track placement and course choices, but are least likely to have access to such advise, either from school personnel or parent conversations in the home (Eccles, Vida, Barber, 2004; Nagy, Trautwein, Baumert, Koller, & Garrett, 2006).

The social influence from parents, teachers and peers may be the most important at the beginning of the tracking process, during the transition in to middle school (Dauber, Alexander, & Entwisle, 1996). Akos, Lambie, Milsom, and Gilbert (2007) found that students of lower socio-economic backgrounds either choose or are encouraged to pursue academic paths that limit future educational and career opportunities. Akos, Lambie, Milsom, and Gilbert (2007) and McFarland and Rodan (2009) assert that these choices have the potential to help maintain a cycle of poverty. They found that course selection by the student may not always be based on academic ability, but instead their limited aspirations that have evolved from their life circumstances. Further, Akos, Lambie, Milsom, and Gilbert (2007) illustrate this situation by saying,

> A student might aspire to become a biologist, but if peers believe that the job has no value, parents indicate they cannot pay for college and teachers do not

> encourage rigorous coursework, the student might compromise that aspiration for one viewed as more prestigious to peers, more affordable to attain, and more in line with teach teachers expect.
>
> (p.7)

Similarly, Shapka, Domene, and Keating (2006) found that as students get older, they tend to consider realistically their initial post-secondary goals and potential barriers to the attainment of those goals. They believe this leads some students to abandon their original goals for another career path, which they perceive as being more attainable. In situations in which children have witnessed their older siblings drop out of school or heard their parents talk about the hardships of high school or about abandoning post-secondary degree attainment, some students may determine that working hard in school and enrolling in rigorous coursework may not be worth the effort. This leads to students from disadvantaged backgrounds to become less likely to identify college attendance as a post-secondary goal (Akos, Lambie, Milsom, Gilbert, 2007; Valadez, 1998).

Students also tend to select their coursework based on their perceived ability in relationship to other classmates (Nagy, Trautwein, Baumert, Koller, & Garrett, 2006; Chiu, et al., 2008; Tyson, 2011). In fact, a student's perception of their ability in a particular subject area proved to be a more powerful predictor of course selection, than a student's reported interest or motivation in that particular subject area. Students also make comparisons across subject areas, for example they may compare their ability in mathematics to another student's ability in English. If they perceived their ability to be better than another students, they are more likely to enroll in a more rigorous level of coursework (Chiu, et al., 2008; Nagy, Trautwein, Baumert, Koller, & Garrett, 2006). Tyson (2011) says that some students opt out of upper level coursework as a matter of

"self-protection." That is, even when teachers have recommended students for upper level coursework students chose to take a lower level class because they are not sure they could pass the upper level class, or because they know they could earn higher grades in the lower level class.

When students are selecting coursework they also look to their peers, in terms of social acceptance and friendships. Riegle-Crumb, Farkas, and Muller (2006) found that students are more likely to form friendships with students they are in classes with. When students are grouped by ability, or other factors, in early grades, it is more likely that students in lower tracked classes become friends with each other. This makes it more likely that when students are able to choose their own coursework in middle or high school that they will continue to select courses based on friendships, instead of based on ability. It is also noteworthy that this same trend is likely to occur in high tracked courses, that is students that may not have particular talent in the academic area select the upper level coursework, in order to stay with friends (Tyson, 2011).

Friends' knowledge and academic skills represent a potential source of social capital for middle and high school students, since students are willing to accept information or advice from their friends as trustworthy sources (Riegle-Crumb, Farkas, & Muller, 2006; Ryan, 2001). Ryan (2001) describes two ways that friendships may influence student's course-taking decisions. First, social reinforcement may play a role in achievement beliefs and behaviors that are discouraged or received negatively by the peer group are less likely to be displayed again by an individual. Second, modeling processes are likely to be involved in peer influence; observing a friend's commitment to schoolwork or hearing a friend voice a belief about the meaning of school may introduce

an individual to new behaviors and viewpoints. Further, high ability students from low socio-economic status backgrounds, may be the most sensitive to picking up on these cues from their peers. (Schofield, 2010). Steinberg (1996) also found that some students are reluctant to enroll in upper level coursework because they are concerned about what their peers, who do not earn good grades in school, will think of them.

Through a series of semi-structured, face-to-face interviews with students from a variety of backgrounds and ethnicities Tyson (2011) found that most students consider what classes their friends are enrolling in, when selecting their own course placement. Students identified friendships as a reason for deferring from a counselor or teacher's recommendation for course placement, both as a reason to enroll in a higher or lower track placement. In her research Tyson (2011) found that the one exception to this pattern was when students were planning to attend college. She found that these students were more likely to enroll in college preparatory coursework, regardless of their friend's choices because they felt they had more "at stake." However, it is also noteworthy that when students made this course selection decision and were not in classes with their friends, they reported that they were less likely to participate in class and did not feel as comfortable in the courses, as they did when they were enrolled in classes with friends (Schofield, 2010; Tyson, 2011).

Dauber, Alexander, and Entwisle (1996) found that even when students from high socio-economic status backgrounds choose to enroll in lower academic tracks, they are more likely than students from disadvantaged backgrounds, to have their course selections overridden by school personnel so that they may be placed in higher tracks in middle and high school. They say this may be due in part to the fact that school

personnel may react to students' socio-economic levels in ways that produce differential education attainment. It is the collection of these findings that lead Willms (2003) to assert that the current system of placement of students into academic tracks places high achieving students from low socio-economic status in double jeopardy. These students are less likely to be recommended in to the academic track in the first place and if they obtain the academic track recommendation, their parents are less likely to enroll them in the academic track. Additionally, these students may be less likely to have peers to model the pro-school behaviors that are not being modeled at home.

The placement or selection, of students in to these academic tracks has lead to a phenomenon referred to as the "socio-economic gradient" (Adler, Boyce, Chesney, Cohen, Folkman, Kahn, & Syme, 1994) or the "cumulative advantage process" (Caro, McDonald, Planck, & Willms, 2009). Tyson (2011) refers to the practice of tracking in American public high schools as a way to interrupt integration after the landmark ruling in Brown versus the Board of Education decision. These references point to the fact that the disparity of achievement between students from advantaged and disadvantaged backgrounds, and as a result black and white students, tends to widen as students spend more time in school (Burris, Wiley, Welner, & Murphy, 2008; Gamoran, 1992; Kelly, 2007). Caro, McDonald, Planck and Willms (2009) found that the achievement the gap between students from various backgrounds remains stable from the age of 7 to 11, and then students from lower socio-economic status families increasingly diverge from their higher socio-economic status peers until the age of 15. This may be due, in part to the academic tracks students are placed in from the beginning of their school careers.

Students in various academic tracks may experience a widening of achievement differences for a variety of reasons. Perhaps the most obvious of these reasons is the exposure to the curriculum. Caro, McDonald, Planck, and Willms (2009) argue that because learning is a hierarchical process, as soon as some students have access to knowledge that other students do not have access to, the students placed in lower tracks are at a decided disadvantage in both the ability to move up a track because their lack of curriculum exposure will be demonstrated on future tests of ability and achievement. For some students, this tracking process may begin as early as elementary school, thus placing them at a disadvantage when selecting middle and high school course placement, which many studies have found to be one of the best indicators of persistence in high school and post-secondary degree attainment (Akos, Lambie, Milsom & Gilbert, 2007; Dauber, Alexander, & Entwisle, 1996).

In fact, there is a strong correlation between middle school and high school track placement English & math course taking. (Dauber, Alexander, & Entwisle, 1996), as well as a strong correlation between foreign language course-taking and high school track placement (Rosenbaum, 1976). Additionally, tenth through twelfth grade academic track students gained significantly more on tests of math, science, reading, vocabulary, writing, and civics compared to similar students in general and vocational tracks (Gamoran, 1987). Schiller and Muller (2003) argue that student course placement as freshman creates a positional advantage for gaining access to advanced level courses, which are related to greater gains in academic achievement and entry into postsecondary schooling. This relationship between early academic course-placement and its lingering effects has lead Eccles, Vida, and Barber (2006) to label a student's 8th grade course selection as a

gatekeeper to college enrollment, because 8th grade is typically the time to select courses that are prerequisites for high school courses. Also, exposure to the curriculum at this level impacts high school course selection because the material students learn can hinder or improve students' capacity to perform on tests. The results on such tests are then used to justify the positions of students in academic tracks the following year (Zevenbergen, 2005).

Another reason students in different tracks may achieve at different levels is due to teacher expectations in various classes. When questioned about teaching practices used in mixed ability and tracked classes, Hallam and Ireson (2005) found that the same teachers responded to questions about appropriate teaching techniques differently. This difference in survey responses is likely due to the finding that when students are placed into ability groups, a set of expectations about academic ability is formed by teachers (Harris, 2010). These expectations are so powerful in the classroom that a teacher's awareness of individual academic abilities is depressed (Anasalone, 2010).

Unfortunately, in lower tracked classes, teachers have low expectations for students' abilities, behavior, and work ethic (Hallam & Ireson, 2005; Harris, 2010; Muijs & Dunne, 2010; Oakes, 2005). This, in turn leads to teachers employing different teaching practices, based on the level of the tracked course (Hallam & Ireson, 2005; Harris, 2010; Oakes, 2005). In particular, students in lower tracked classes are more likely to be exposed to watered down curriculum and spend less time on task (Harris, 2010). Through interviews with students, Schornick (2010) reported on specific times during a students' experience in a lower tracked class that teachers conveyed low expectations for their students, that the students were acutely aware of. Students were

able to give examples of times students cheated in class, or did not complete their homework, and the teacher did not address the behavioral problems. In the eyes of the students, this translated in to the teacher not caring if they learned the required material or not. Chazan (2000) suggests that teachers may water down curriculum in lower tracked classes because of an unspoken agreement between the teacher and her students. These agreements between the students and teacher dictate that the students will not disrupt class, as long as the teachers do not make heavy intellectual demands. Teachers who disregard or are unaware of such expectations in lower-tracked classes run the risk of students disrupting class and becoming a discipline problem.

Whether watered down instruction occurs because of a teacher/student treaty or because of lowered expectations, teachers are more likely to spend time on exercises of rehearsal and repetition of structured, practical work and less time on discussion of material in classes with lower ability students (Hallam & Ireson, 2005; Oakes, 2005). Another explanation for lower quality teaching practices is the finding that less qualified teachers, in terms of years of teaching experience and education, are assigned to teach lower tracked courses (Muijs and Dunne, 2010). Even in mixed ability classes teachers reported they had different expectations for high ability students, compared to the rest of their classmates. Specifically, teachers expected high ability students to engage higher levels of analytic thinking, work at a faster pace, and to take more responsibility for their written work. This is consistent with the findings by Harris (2010) that even when teachers are expected to teach regular and high tracked classes the same material, the material was taught to these groups of students in different ways.

Tracking has also been shown to impact students' self-perception of their own ability in specific academic courses, and their attitude toward schooling as a whole (Hallam & Ireson, 2005; Muijs & Dunne, 2010; Schofield, 2010; Tyson, 2011). Schofield (2010) asserts that when students are placed in tracks some students may label themselves as "good" or "poor" students. These self-imposed labels have the potential to impact student achievement in the classroom, leading to depressed student achievement in lower tracks, and increased student achievement in the higher tracks (Muijs & Dunne, 2010). Similarly, Hallam and Ireson (2005) found that when students are placed in lower tracked classes they lower expectations for themselves in terms of academic achievement and future goals, thus making depressed academic achievement a self-fulfilling prophecy. Because of this depressed academic achievement, they are less likely to be recommended for higher track placement in subsequent classes, thus leading to a cycle of low expectations, leading to lowered academic performance, leading to low track placement. Because of the expectations of students and teachers this cycle becomes difficult for the student to break. This cycle also leads to low socio-economic students having poor experiences in school, making them more likely to leave school altogether (Alexander, Entwisle & Kabbani, 2001; Caro, McDonald, Planck, & Willms, 2009). On the flip side, Kelly (2007) finds that students in high-track classes benefit in a variety of ways by experiencing school from a privileged status assignment. Because of placement in high tracked classes, these students are more likely to have pro-school attitudes, higher expectations of educational and occupational success for themselves, and form friendships with similarly privileged students. This type of school experience also leads to improved academic growth.

It is the collection of these findings that lead the National Research Council to publish the report *Engaging Schools: Fostering High School Students' Motivation to Learn* (National Research Council and the Institute of Medicine, 2004), which calls for comprehensive school reform. One of the key components of that school reform is to radically change tracking in the American High School, school system. The main goal of this report was to increase educational outcomes, in terms of post-secondary attainment, and achievement data for low income and minority students (Harris, 2010). The National Research Council and the Institute of Medicine (2004) asserted eliminating or reducing the use of tracking, or in particular the use of flexible tracking could best achieve this goal. Additionally, the use of heterogeneous grouping was the hallmark recommendation of this report. For the most part, high schools and middle schools have not followed the recommendations published in 2004, largely because of teacher and parent resistance to de-tracking (Harris, 2010; Lareau, 2002; Loveless, 1999; Oakes, 2005).

The Special Case of Course Assignment or Selection in Mathematics

Many of the issues surrounding tracking in the school system are magnified in the subject area of mathematics. Daniel Chazen (2000) asserts that while some of the problems experienced by students and teachers of mathematics are present in all subject areas with tracked classes (for example, inconsistent tracking practices and lower student and teacher expectations), there are peculiarities surrounding the field of mathematics that make tracking in the area of mathematics particularly important. He explains that mathematical knowledge is high-status knowledge in the American society. This idea, coupled with the misconception that mathematics is a "cut and dry" subject, with a clear set of rules to be followed has lead many students to reason that mathematics is alien and

unattainable to them. Further, this line of reasoning puts distance between students from lower tracked mathematics courses and their teachers, who presumably have the ability in mathematics that these particular students lack.

There are three principles employed in the teaching of school mathematics that further these cultural ideas, making tracking more acceptable in mathematics, in comparison to other courses:

1. All statements of school mathematics can be judges as right or wrong.
2. The central role of the teacher is to exercise this judgment.
3. These judgments can be used effectively to label students' "ability" or aptitude in mathematics (Chazen, 2000).

Further evidence of the lock-step attitude toward mathematics, compared to other subjects taught in school is the references to mathematics course assignment or selection as "entering the mathematics pipeline," (Walker, 2003) or a student's "trajectory," (Berryman, 1987; Chazan, 2000). Both the use of the word trajectory and pipeline, indicate that once a student has entered the specified course of study movement from their chosen path, is difficult if not impossible. The reference to mathematics course taking using these metaphors also speaks to the need for taking mathematics courses in a particular sequence, that does not necessarily exist with other curricular areas, such as reading, and social studies.

Additionally, enrolling in advanced coursework in mathematics is a strong indicator of post-secondary success. Students enrolling in advanced coursework (that is coursework beyond the Algebra II level), are more likely to both attend and finish college, more likely to enroll in a selective four-year university (Riegle-Crumb &

Grodky, 2010), and more likely to have high educational goals for themselves and take more rigorous classes in high school regardless of subject area. (Oztuk & Singh, 2006; Schornick, 2010).

Because of the nature of mathematics instruction, many times students only learn upper level mathematics concepts in the mathematics classroom. It is socially acceptable to make some concepts in mathematics and science courses accessible to some students, in a way that is not acceptable in reading instruction. The culturally held view that some people are mathematicians and scientists, but that everyone must learn to read, makes it acceptable for schools to differentiate in the areas of mathematics and science sooner and in ways that give some students access to knowledge that other students will not ever have access to (Marks, Cresswell, & Ainley, 2006). Because of the specialized nature of mathematics and science course taking, between and within school differences are likely to be stronger for mathematics and sciences than for reading (Gamoran, 1987; Marks, Cresswell, & Ainley, 2006). Similarly, Schofield (2010) found that the earlier schools differentiate reading and mathematics instruction for students, the wider the achievement gap between students from varying socio-economic backgrounds becomes.

An analysis of 2003 TIMSS data from 54 countries showed that early tracking into differentiated learning environments lead to a large disparity between students from varying socio-economic backgrounds, showing that early entry in to the science, technology, engineering, and mathematics (STEM) pipeline places students at a decided advantage in many school systems throughout the world. (Schofield, 2010). Additionally, Hoffer (1992) found that the school's average socio-economic status has no bearing on whether or not the school tracks 8th grade students in to science courses, but

that it is positively associated with tracking in 8th grade mathematics coursework. Further, Hoffer (1992) also found that grouping in mathematics and science during 8th grade had no significant effects on a student's academic performance during that school year, that is there was no significant score difference between high and low tracked students in mathematics and science. Instead the effects of the 8th grade mathematics placement were likely realized as they moved through the mathematics pipeline in high school.

As with track placement in many other curricular areas, many times students are placed in mathematics tracks in elementary school based on standardized test scores, which tend to favor white and Asian students, who are more frequently from affluent backgrounds; thus placing black and Latino students at a disadvantage at the beginning of their mathematics careers in school (Walker, 2003). Walker (2003) also argues that this method of placing students in mathematics tracks helps to perpetuate the misconception that some students (namely affluent white and Asian students) are natural mathematicians, while other students are not.

Although early differentiation of mathematics instruction has been shown to widen the achievement gap between students of varying economic backgrounds, much evidence exists to suggest that mathematics course taking in middle and high school have the greatest effect on student achievement in mathematics. This finding is largely due to the fact that formal entry in to the mathematics pipeline begins either with a student's middle or high school mathematics course assignment or selection. At the age of 12, the achievement gap (which is already wide) continues to widen significantly until graduation from high school (Caro, McDonald, Planck, & Willms, 2009). Sixth grade

mathematics placement has been shown to depend more on social background, compared to eighth grade mathematics placement (Dauber, Alexander, & Entwisle, 1996). This is likely due to the fact that by 8th grade, students' mathematics placement has already been decided for them, based on their 6th and 7th grade mathematics placement. The *Condition of Education 2010* report's special section on high-poverty schools (Aud, S., Hussar, W., Planty, M., Snyder, T., Bianco, K., Fox, M., Frohlich, L., Kemp, J., Drake, L., 2010) shows a large disparity in mathematics achievement between high and low poverty schools.

Walker (2003) hypothesizes that this disparity exists because in elementary school differences in academic achievement can largely be explained by the quality of instruction that students receive from their teachers and not by race or socio-economic status. This difference in achievement is due to funding inequities and teacher shortages that often result in urban school students being taught mathematics by teachers who are less qualified and more inexperienced, compared to teachers working in suburban schools--thus urban school students often receive mathematics instruction centered on basic skills and repetition, rather than instruction that provides them with opportunities to learn and exercise higher-order thinking skills. This hypothesis is also supported by the findings in the *Condition of Education* (Aud, et al., 2010) report, which found that 52% of teachers working in schools with 0 – 25% of their population qualifying for free or reduced lunch had master's degrees, compared to 32% of teachers working in high-poverty schools (Aud, et al., 2010). Additionally, William and Bartholemew (2004) find that teachers teaching lower tracked mathematics classes were generally the least well qualified to teach mathematics among the mathematics in their school. They also seemed

to expect less from their students, in terms of work and mathematics ability. Teachers in lower mathematics tracks often assigned work that was cognitively undemanding and used a narrower range of teaching approaches. Additionally the teachers seemed to rarely respond to students' frequent requests for more demanding work. On the other hand, higher tracked mathematics courses were more often taught by well-qualified teachers, who tended to go too fast for many students. The most interesting finding from this study was that when teachers taught tracked mathematics courses, teachers were more likely to treat every student in the class as if they had the same ability level in mathematics. However, when these same teachers, were teaching mixed-ability classes, they used a wider range of approaches and took greater account of individual differences. In short, they employed practices of good teaching more often, even though they liked teaching mixed ability groups less.

In much the same way that 8th grade mathematics placement depends on previous performance, 9th grade mathematics placement depends on middle school placement and performance (Crosnoe & Schneider, 2010). Because of the nature of mathematics course work, namely that there is a specific sequence of prerequisites that must be taken, in order to enroll in the next mathematics course, Kelly (2007) argues that mathematics track placement for all four years of high school is determined by the assignment or selection of a student's freshman level mathematics course. Even in schools where formal track placement is not used, Schiller and Muller (2003) found that the sequential nature of mathematics limits students' options in mathematics course enrollment, and that these limitations can span both grade levels (i.e. 6th grade placement depends on 5th grade mathematics placement) and school buildings (i.e. the transition from middle school to

high school mathematics courses). Kelly (2007) found that course offerings for freshman students mostly consisted of enrollment in algebra or geometry, however each of these courses were further differentiated, allowing some students to graduate with the required number of years of mathematics without enrolling in an advanced algebra course in high school.

Shapka, Domene and Keating, (2006) call 9th grade mathematics placement a filter, because it limits students' future options; many post-secondary programs require certain levels of high school mathematics performance. Thus, this filtering process may limit a student's post secondary enrollment plans, and later, their career aspirations by the age of 14. Updegraph (1996) illustrates this by saying "course enrollment decisions are among the most influential self-regulatory behaviors students exercise in school because these decisions directly affect the opportunities students have to learn new material." Further, Riegle-Crumb and Grodaky (2010) assert that the hierarchical organization of high school mathematics courses is an important mechanism of academic stratification. They go on to say that,

> A highly structured system of prerequisites that begins in middle school with algebra or pre-algebra dictates that only those students who have mastered the curriculum and met teachers' expectations consistently of a period of may years are given the chance to participate in advanced math courses such as pre-calculus and calculus.
>
> (p.250).

Given the seemingly inflexible nature of mathematics course sequencing, it is not surprising that enrollment in algebra as an 8th grader puts students at a decided advantage when enrolling in high school mathematics courses. Smith (1996) and Schiller and Muller (2003) found that students who enrolled in algebra in 8th grade continued to take

college preparatory mathematics courses. Additionally, they stayed in the mathematics pipeline longer and advanced farther than their contemporaries who took algebra in high school. Both Smith (1996) and Walker (2003) found that students tended to be assigned to 8th grade algebra courses if their parents were involved in school, were married, white, and from a high socio-economic status background. Black, Latino, and poor white students were less likely to be assigned to algebra in 8th grade, regardless of test scores or previous mathematics course performance.

Similarly, Crosnoe and Schneider (2010) found that a family's socio-economic status differentiated students at their starting and ending levels of mathematics course taking in high school. Even when students had the same prior experience in mathematics; attending the same kinds of schools, having the same mathematics achievement on standardized tests, the difference in initial mathematics placement in high school, was the largest among the students scoring poorly on middle school mathematics tests. In fact, Schnabel, Alfeld, Eccles, Koller, and Baumert (2002) found that students scoring 1 standard deviation higher on a 7th grade mathematics achievement test and students whose father had a high level of post-secondary education were equally likely to be placed in the highest mathematics track in high school. The socio-economic status difference in total mathematics credits earned at the end of high school was the largest among the students starting high school in a low-level mathematics course. That is, in both situations students from a higher economic background tended to persist in mathematics courses longer and be placed in a higher mathematics track at the beginning of high school. These findings lead Crosnoe and Schneider (2010) to hypothesize that students from advantaged backgrounds, although starting at a low level of mathematics

ability and course placement have parents or other role models who understand the importance of mathematics attainment and persistence, thus encouraging these students to continue in their mathematics course work in high school. In contrast, when students from disadvantage backgrounds continue to persist in mathematics or enroll in challenging mathematics courses these students may elicit the encouragement of outside sources, such as a teacher or counselor, to encourage them to continue in their mathematics course taking. Thus, low ability mathematics students from disadvantaged backgrounds start low in mathematics course placement and achievement and continue to fall farther behind their middle and upper class peers. (Crosnoe & Scheinder, 2010).

The findings from the National Center of Education Statistics 2008 study on end of course taking in mathematics, assert that mathematics achievement is linked to mathematics course-taking (Bozick & Ingels, 2008). Students from the highest quartile of socio-economic backgrounds earn, on average, 3.5 Carnegie Units in mathematics by the end of high school, compared with students in the lowest quartile earning 2.1 Carnegie Units. Additionally, students from high socio-economic status background are making greater gains in mathematics achievement (due to advanced course-taking). High socio-economic status students start high school with higher mathematics achievement scores, enroll in more advanced mathematics courses, and make greater gains in mathematics achievement in advanced topics. The gains made by students from low socio-economic status backgrounds are largely in the area of intermediate mathematics, and do not move beyond the algebra II level. The largest improvements in the area of mathematics achievement were made by students who took pre-calculus and one other course during their last two years of high school; nearly 30% of all students from the

highest quartile of socio-economic status enrolled in a course sequence that included pre-calculus; only 11% of students from the lowest quartile followed the same course sequence pattern.

As with tracking in other subject areas, students are assigned to tracks, but in some cases they are also given the opportunity to select into particular courses or tracks. Toward the end of mathematics course-taking in high school students are also given the opportunity to select both the type of mathematics course in which they will enroll or whether or not to enroll in a mathematics course at all. In 2004, 26 states required at least 2.5 Carnegie Units in mathematics for graduation, thus many states allow students not only to choose their mathematics course sequence, but also to decide whether or not they will even take mathematics toward the end of their high school career (Bozick & Ingels, 2008). Berryman (1987) asserts that one of the major deciding factors in a student's course enrollment is their perceived niche in society, upon graduation from high school. She writes:

> I suggest that all children develop an image of their niche in the adult world [. . .]They seem to work out notions of their basic futures and of the trajectories relevant to them, even if they cannot state these explicitly. And they act on these ideas, such as electing into or out of advanced mathematics [. .]. The child who scrapes by to high school graduation or who drops out, or behaves so intolerably that he or she is pushed out, may not be able to envision and emotionally claim an adult future that requires the core curriculum of high school.
>
> (p.9)

Chazan (2000) goes on to discuss the idea of a student choosing their trajectory by arguing that a student's selection out of mathematics altogether, or into a lower mathematics track may be due to the fact that their perceived trajectory and the content of an upper level mathematics course (or any mathematics course) do not match. Thus,

when teachers or other school officials reason with students that mathematics course enrollment will be advantageous to them for future course enrollment or college attainment, these students do not enroll in mathematics coursework because they do not think these goals apply to them. Shapka, Domene, and Keating (2006) also found that students who experienced a low grade in math, started out with lower expectations for their careers, and their aspirations declined at a much more rapid pace from mid high school onward. Additionally, Smith (1996) found that mathematics achievement in the early part of high school is the single strongest predictor of whether a student will continue to take advanced courses in mathematics and of later mathematics achievement in high school.

The findings from the *Mathematics Course Taking and Achievement at the End of High School: Evidence from the Educational Longitudinal Study of 2002* (Bozick & Ingels, 2008) support Chazan (2000) and Berryman's (1987) hypothesis, finding that educational expectations of students were linked with mathematics learning. Students who expected to attend college performed better on the 12th grade NAEP mathematics assessment than their peers who expected to complete high school or less. Additionally, 7% of students who expected a college degree when enrolled in 10th grade later followed a pre-calculus--AP/IB Calc sequence. However, less than 1% of those who expected to attend some college and those who expected a high school degree followed this same curricular path; 4% of students who expected a BA took no mathematics courses, compared with 14% of those who expected a high school diploma or less. Similarly, Kelly (2004) found that 8th grade students who expected to enroll in a college preparatory mathematics track and were very sure they would graduate from college, had

a 38% higher probability of being in one of the top 3 mathematics sequences by their sophomore year, compared to a student who does not expect to graduate from college. Crosnoe and Schneider (2010) suggest that because mathematics courses move from required to elective, by the end of a student's high school career, a student's mathematics trajectory can be viewed as a sequence of decision-making points with potential for self-propagation and that students from advantaged backgrounds understand the importance of this self-propagation, in relationship to future goals.

The relationships students have with their friends and their parents (in particular their mothers) play a role in the student's decision-making process for end of high school mathematics course taking. Hammouri (2004) studied high school student's responses to a student questionnaire as part of the TIMSS data, as well as their course-taking patterns. He found that student's perceptions of the importance both their mother and friends placed on mathematics closely mirrored their opinion on the importance of mathematics course-taking and mathematics achievement. Although both of these relationships played an important part in the student's mathematics career, the impact of both the mother's and friends' perceptions interacted with the student's opinion differently. The mother's opinion of the importance of mathematics seemed to have a direct effect on a student's achievement in mathematics. On the other hand friends' opinions about mathematics seemed to impact a student's attitude toward mathematics, which in turn lead to enrollment in higher mathematics course placement and better mathematics achievement.

Similarly Schornick (2010) found that student's home experiences impact their beliefs about mathematics and their mathematical activity in the classroom. Parental educational expectations for their children and involvement in their child's mathematics

learning are two major factors that influence a student's expectations for themselves, their attitude toward mathematics, and their self-confidence in doing mathematics. Additionally Schornick (2010) finds that mathematics achievement of children from low socio-economic status families is more heterogeneous than the achievement of children from high socio-economic status backgrounds. The mathematics achievement in courses where the students have a high mean socio-economic status is more homogeneous than the achievement in classes with low mean socio-economic status. In other words, there are almost no differences in variance of students' mathematics achievement between socio-economic status groups when they are enrolled in classes with an overall high mean socio-economic status, and a big difference in variance between students in classes with a low mean socio-economic status. This is partly due to the fact that students from high socio-economic status backgrounds perform at a high level of mathematics achievement, regardless of their mathematics course placement, while students from low socio-economic status backgrounds tend to be very sensitive to their surroundings, in terms of mathematics achievement. In other words, when students are unable to pick up on cues about the importance of mathematics from their parents or their life outside of school, they are more likely to take these cues from their mathematics teachers and classmates. (Opdenakker, Van Damme, DeFraine, VanLandeghem, Onghena, 2002; Oztuk & Singh, 2006). In a similar study of TIMSS data Wang (2004) found that among Chinese and American students the five predictors of increased mathematics achievement were higher expectations from mothers to do well in school, being assigned to high-achieving classes, the presence of study aids (such as books and computers) in the home, and living with both the child' birth mother and birth father.

Oztuk and Singh (2006) go on to say that in order for children to be successful in mathematics they must be able to translate their achievement into high educational aspirations and to continue taking non-required advanced mathematics courses. This naturally occurs in homes of children with highly educated parents (who are typically from a higher socio-economic background). However it is important that students from disadvantaged families have this experience at school.

Updegraph (1996) uses the Expectancy-Value Model of Achievement Choices to analyze a child's mathematics coursework decision. The model uses the motivational and social factors that influence long and short term achievement goals, behaviors, future career plans, course selection decisions, persistence on difficult tasks, and the effort the child decides to exert across various achievement-related activities. The most important aspects of this model are the child's expectations for success and the value the child attaches to the various plausible options. By using the model Updegraph (1996) predicts that children will most likely enroll in courses they think they will both do well in and are valuable to them. A student's expectation for success is dependant on the confidence they have in their own intellectual abilities, the perceived difficulty of the course, whether or not the child enjoys the subject, and their parent's and friend's perception of important of the course.

Parental Connoisseurship

Parent involvement in a child's school experience can influence both the quality and length of a child's schooling. Success in school depends on a family's involvement in preparing their children for the beginning of formal education and the extended involvement of parents once formal schooling begins. Inversely, parents of school

children also must depend on schools to provide their students with a quality education and give them the tools to be successful after formal K – 12 schooling is complete. Ideally, this give and take relationship functions best when schools and parents work together toward a common goal of quality schooling for their children.

Numerous studies have been conducted on the various ways parents become involved in the school-lives of their children (for example, Dauber, Alexander, & Entwisle, 1996; Lareau, 2002, 2004, 1998; Lareau & Cox, 2011; McFarland & Rodan, 2009; Reigle-Crumb, & Grodsky, 2010) and the implications of such involvement. Many of these same studies have found that while most parents, regardless of race or social class, are involved in the school-lives of their children, parents from higher socio-economic status backgrounds and with more education, tend to employ more effective methods of involvement in the school-lives of their students, as measured in grades in school, track placement, course selection, and persistence toward high school graduation. These all lead to a more meaningful educational experience for their children, in terms of both long and short term achievement effects as well as positive social experiences with teachers and other school personnel within their child's school experience.

Lareau and Cox (2011) classify the importance of parental involvement in the institution of schooling in global and case-specific ways. When parents participate in their child's schooling globally, they understand the education system as a whole. For example, parents understand that enrolling their students in the highest tracks available, regardless of the academic area or grade level, will produce larger dividends at the end of the child's school career. Parents also interact with their child's school in case-specific ways, including coming in to a teacher's classroom to discuss a specific incident at

school that the parent thinks needs more attention. It might be a grade on a particular homework assignment or discipline received at school. Lareau and Cox (2011) find that middle class families tend to possess more global and case-specific knowledge about their child's school and academic performance, than their working and lower class counterparts. They are able to use this knowledge to "untie knots" in their child's school experience. Through personal correspondence with Professor Lareau (October 17, 2011), she points out that the act of parents untying knots for their children in one case when dealing with the school may or may not have an impact on the overall educational outcome of their students. However, it is knowing when to untie these knots and the succession of intervening in their child's school experience that ultimately differentiates the way middle class parents intervene to influence their child's school experience, compared to working and low class parents.

In order to analyze the ways parents are able to untie the knots in their child's school experience, I use the term parental connoisseurship. Parental connoisseurship is a parent's work with schools, their communities, social ties, and with their children and other family members to benefit their children's educational outcomes and future success. Examples of parental connoisseurship are volunteering at school, parent-teacher contact, involvement in academic-related activities at home, the use of personal social relationships, and the quality of parent-teacher relationships. It is the combination of these actions and interactions between parents, society, school, and child that I have defined as parental connoisseurship. For the purpose of this definition, parental connoisseurship is the action of the parents with the factors of society, school, and child that are important, instead of simply the interactions between these groups.

I also use Hill's, et al., (2004) definition of academic involvement, as well as Lareau's (2002) and Coleman's (1987) definitions of concerted cultivation and social capital. Hill defines parental academic involvement as parents' work with schools and with their children to benefit their children's educational outcomes and future success. Concerted cultivation is a parent's deliberate and sustained effort to stimulate children's development and to cultivate their cognitive and social skills. (Lareau, 2002). According to Coleman (1987) social capital is raising children with the norms, social networks, and relationships between adults and children that are of value for the child's growing up. Social capital can exist within and outside the family.

I further delineate the term parental connoisseurship by classifying parent connoisseurship as direct or indirect. Parents interact with their child's schooling experience in two distinguishable ways; indirectly, defined by the actions parents take to enhance their child's school experience, although not dealing directly with the institution of school; or directly, by using the institution of the school to work for their child. Examples of indirect parental connoisseurship include teaching children social norms appropriate for school, asking their children about their schooling experience, using social resources, such as personal relationships with school personnel and other knowledgeable community members, instilling high academic and occupational expectations, and affording them educational opportunities outside the school day. Direct parental connoisseurship includes, parents meeting with their child's teachers, taking an active role in the life of the school by volunteering, and meeting with school officials such as principals and school counselors to ensure their children are getting the highest quality education possible. It is necessary to distinguish between the two types of

involvement for two main reasons: 1) schools request that parents are both directly and indirectly involved in their child's academics 2) parents from different educational and socio-economic backgrounds engage in these varying types of academic involvement in different ways, with different levels of success, in terms of academic achievement and experience for their child.

Direct Parental Connoisseurship in the School Experience

Direct parent involvement in a child's school experience is the type of involvement that occurs within the walls of the school. Typically, this type of involvement is engaged in by middle and upper class parents (Baker & Stevenson, 1986; Burris, Wiley, Welner, & Murphy, 2008; Hill, Castellino, Lansford, Nowlin, Dodge, Bates & Pettit, 2004; Kelly, 2004; Lareau, 2000, 2004; Ma, 2000) more frequently and with more success because these parents are more likely to possess global knowledge about the institution of schooling and case-specific knowledge about their child and their child's school than their lower income counterparts. In light of this knowledge, middle class parents are typically more comfortable working within the socially acceptable norms of the school.

In her 1987 book *Home Advantage*, Lareau observed that parents from low socio-economic status backgrounds feel uncomfortable navigating the social norms of their children's schooling experience. This is due, in part, to the fact that they view their children's teachers as socially superior to them mostly because they have more education then they. Additionally, these parents feel that, even if they have the time, they do not have the academic background to effectively volunteer in their child's classroom, or to question the decisions of the teacher. In general, parents from low socio-economic

backgrounds view their position of supporting the school as one in which the decisions of the teachers and school administrators should not be questioned. Unfortunately, many times teachers misinterpret this hands-off support as parents not being interested in the lives of their school children.

Additionally, Epstein and Dauber (1991) noted that parents who are not involved in their child's school experience may simply need to have the expectations and needs of the school explicitly stated for them. Parent volunteers in the classroom is a relatively new phenomenon and it is one that many parents may participate, especially if they have witnessed their peers working as school volunteers. When parents do not have someone in their social circle with which to learn about the social norms of the school, they are much less likely to volunteer in their child's classroom.

Although, parents from lower socio-economic status backgrounds tend to view education as the schoolteacher's job, Lareau (2000, 2004) and others (Baker & Stevenson, 1986; Hill, et al., 2004; Kelly, 2004) found these parents still expect their children will be able to use their education as a vehicle for social mobility. Parents asked their children about school, were concerned about decisions being made on behalf of their child's educational experience, and tried to convey the importance of schooling at home. These are all important examples of indirect parental connoisseurship that may not be seen or appreciated by schoolteachers and other school authorities. The major difference in these beliefs was the way in which parents acted on these beliefs in the lives of their children.

Parents from low socio-economic status backgrounds do engage in limited forms of direct parental connoisseurship. Mostly frequently this is represented by parent's

attendance at parent-teacher conferences. In part, this may be due to the fact that this is an expectation conveyed to all parents by sending home notes and other reminders through schoolchildren, or through direct contact with the parents (Epstein & Dauber, 1991; Hoover & Dempsey, 1997; Lareau, 2004).

Attendance at parent-teacher conferences is a form of direct parental connoisseurship, however it is fundamentally different from other forms of direct involvement, in that other forms of direct involvement (for example volunteering at school, coming in to discuss problems/questions with school personnel) are not widely publicized ways to become directly involved in a child's school experience. Many times, parents learn of these methods of direct involvement through conversations with other parents of school children, or from their own experience in working through other, similar social institutions. These types of experiences are not typical among low and working class parents.

In many cases attendance at parent teacher conferences is more of an obstacle for parents from low and working class backgrounds both logistically and emotionally. These parents typically work at jobs with less flexible working hours and have a harder time finding childcare for other children in order to attend conferences. Epstein and Dauber (1997) noted that one of the biggest deterrents for parents becoming involved in their children's formal schooling is a difference in expectations between two social groups of which the parents are members. In this instance, the social group of work may operate under different norms than that of school (for example no vacation days, working evenings, or other coworkers not attending functions at their child's school). Once at conferences these parents tend to feel less comfortable with the educational jargon being

used to describe their child's academic progress in schools, are less comfortable with teacher recommendations for parent involvement at home, and do not feel equipped to question the teacher's authority in the classroom, even when they disagree with the educational assessments of their child. (Hoover & Dempsey, 1991; Lareau, 2004).

However, these obstacles for parents of working class students are not insurmountable, Hoover and Dempsey (1991) found that parental involvement can be improved in schools that take the lead in initiating school to parent contact in order to encourage parents to come in the schoolhouse take an active role in their child's education. They also found that teachers teaching in schools with a homogenous student population (in this case of working class parents) are more likely to actively pursue ways to try to get parents into the school. However, this contact typically tapers off as students enter middle and high school, leaving many of these parents with the same feelings of insufficiency that the elementary school teachers may have worked so hard to overcome (Epstein & Dauber, 1997; Hoover & Dempsey, 1991). The early high school years are arguably the most important times in a child's school experience, in that middle school track placement and course selection may already begin to dictate the types of academic courses students will take in high school.

In contrast, parents from middle and high socio-economic status backgrounds are more likely to participate in a variety of forms of direct parental connoisseurship. For example, in addition to attending parent-teacher conferences, parents from these backgrounds are more likely to enter the school to request that their children be placed in specific courses, even when these parent requests differed from the recommendations made by teachers and other school officials. They are also more likely to intervene in

social and behavioral problems at school, to volunteer, and question classroom decisions being made by the teacher than parents from lower socio-economic settings (Baker & Stevenson, 1986; Burris, Wiley, Welner & Murphy, 2008; Dauber, Alexander, & Entwisle, 1996; Kelly, 2004; Lareau, 2000, 2002).

The very nature of the engagement with the school differs among parents across income and education levels. For instance, parents attending conferences from middle and upper class backgrounds tend to view their child's teacher as a colleague in their child's formal schooling experience. Because of this, Lareau (1987) observed that teachers and parents tend to engage in more conversation about the child's academic experience, as opposed to the information giving and receiving form of communication between working class parents and teachers. The stilted types of conversations typical between teachers and working class parents were more of a function of parents being unsure about questions to ask about their child's progress or from not understanding the information being conveyed to them about their child. Parents from middle and upper class situations typically have more experience meeting new people and making small talk. Although this small talk did not deal directly with discussions about school, Lareau (1987) observed that this small talk at the beginning and throughout the conference seemed to put teachers more at ease making it easier for these parents to obtain more information about their child's schooling experience, which could include important information such as alternate routes for academic decision making, other opportunities for their school involvement, and unpublished policies and procedures for navigating the school experience.

Additionally, parents are more comfortable both participating in the academic lives of their school children they are not bashful about questioning decisions made by schoolteachers and administrators. Dauber, Alexander, and Entwisle (1996) found that when parent's disagreed with a teacher's decision about their child's schooling, middle and upper class parents felt more comfortable voicing their disagreement with the school official. These disagreements sometimes spoke to high stakes decisions, such as being placed in a lower track academic course or being retained. In other situations, higher income parents insisted that their child be assessed by an educational specialist, or expected special education services, even when this was against the better judgment of professional school personnel. These are all examples of parents both feeling comfortable working within the boundaries of the school system, and feeling comfortable navigating the educational jargon even when they themselves were not educators.

In her observations of parent/teacher interactions, Lareau (2002) also found that middle and upper class parents were more comfortable expecting school officials to customize the educational experience of their children. In addition to the expectations described by Dauber, Alexander, and Entwisle (1996), middle and upper class parents were also comfortable going beyond the judgment of the teacher by voicing concerns and expectations to principals and school counselors. Both of these characteristics were missing from the parent/teacher interactions with low and working class parents. This can be interpreted as one of the ways middle and upper class parents tend to view teachers and school administrators as their equals socially and professionally, in contrast to working class parents who view questioning the school's authority as disrespectful.

Parents from middle and upper class backgrounds were also found to enter the school setting in order to request that their students be placed in specific classes (Baker & Stevenson, 1986; Burris, Wiley, Welner & Murphy, 2008; Kelly, 2004; Harris, 2010; Hill, et al., 2004; Ma, 2000). Kelly (2004) found that the practice of requesting specific course placement for middle and high school students was a parental action that actually correlated with placement in higher academic tracks in high school and middle school. The other parent intervention that was positively correlated with high track placement was participation in parent-school volunteer groups (another form of direct parental connoisseurship). However, parent request for course placement was a much stronger correlation than that of participation in volunteer groups. This is also an example of the way parents are able to use their social circles to advance the education of their children. Parents were more likely to request course placement and volunteer in parent-volunteer groups for the school when they knew someone personally who had either requested course placement or volunteered in the school. Coleman (1987) and Epstein and Dauber (1997) emphasize the importance of the use of social circles and connections in schools encouraging this type of parent behavior.

Similarly, Burris, Wiley, Welner and Murphy (2008) found that parents with college degrees were much more likely to become active in their child's course-selection process, resulting in their children taking Calculus while still in high school. Hill, et al. (2004) also found that parents with a college education were much more likely to speak with high school counselors and administrators in order to ensure that their children were enrolling in college preparatory classes while still in high school. Lareau (2004) notes that parents felt entitled to make the school work for them, and had the necessary tools to

make things happen for their children, regardless of printed school policies for course placement. Ma (2000) found that parents from high socio-economic backgrounds advocated for changes in course placements of their students when they lived in an area with fewer choices of schools, thus leading to considerable within school variance in course assignment and socio-economic status. This was especially the case in the academic areas of mathematics and science. Harris (2010) also found that teacher recommendations are one of the determining factors used when deciding on course placement for students. Additionally in her study Brantlinger (2003) found that middle class white mothers in her study think advocating for school advantage (in terms of track placement and course selection) for their children is an important part of being a good parent.

Indirect Parental Connoisseurship in the School Experience

As indicated, indirect parental connoisseurship can also affect a child's school experience in profound ways. Just as schools ask parents to engage in direct parental connoisseurship by sending home letters to parents or making phone calls, schools also expect parents to engage in indirect parental connoisseurship, such as reading to their children, speaking with them about educational activities engaged in at school, assisting with homework completion, and helping to set future educational goals. Although some of this indirect academic involvement may be modeled or requested by the school, teachers and other school officials do not dictate all the ways parents are involved in their child's educational experience outside of the school day.

Laureau (2004) and Coleman (1987) in particular assert that many forms of indirect parental connoisseurship are actually modeled for parents by other adults in their

social circles, whether it be in a church group, or by family members, or work colleagues. Lareau and Cox (2011) quote a child, whose mother worked the school to her advantage,

> I have to go to school and fight for my child. If my mom can do it, then I can do it. I remember her going to school to fight for me all the time […]
>
> (p.13).

The fact that indirect parental connoisseurship may be taught to parents through social circles puts members of low and working class families at some disadvantage, as they may not be put in the position to be exposed to this type of pro-school behavior. Coleman (1987) argues that even when parents cannot or do not become directly involved in parental connoisseurship other social organizations help with the cause. In his 1987 study, Coleman found that students from similar low socio-economic backgrounds enrolled in public and Catholic school dropped out of school at different rates. He attributed this difference, in part, to the social expectations surrounding the students. Students from low socio-economic backgrounds dropped out of Catholic school at the same rate as students from middle and high socio-economic backgrounds, in contrast low socio-economic students enrolled in public schools dropped out at much higher rates. Coleman (1987) points to the sense of community and the normalizing expectations in the Catholic school setting that does not necessarily exist in public schools. He asserts that when parents do not arm their students with social capital, in the form of high expectations for school enrollment and academic achievement, adults in a closer-knit community can fill the void by, in effect, making pro-school behaviors the norm. Similarly, Marks, Cresswell, and Ainley (2006) note that children do better in schools when they have a closely-knit network of adult support around them.

Using Coleman's idea of social capital I argue that part of the problem with students from low socio-economic backgrounds enrolled in public schools is that their relative isolation in the normative environment in a low socio-economic school simply does not carry the expectations for school success that we see in more economically integrated schools this decreases the chances that students who are not getting social capital from their parents are able to get it from other adults in their neighborhood. In particular Coleman says,

> altogether the social capital in family and neighborhood available for raising children has declined precipitously; the loss of social capital in the community hurts most the children with least human and social capital in their families.
>
> (p.559).

Crosnoe, Mistry and Elder (2002) had findings supporting Coleman's Catholic school theory, showing that when parents placed their children in advantaged school environments, parental academic involvement no longer played as big of a role in enrollment in postsecondary education. Similarly Marks, Cresswell, and Ainley (2006) determined that social relationships, defined by stronger connections between students, schools, parents, and the local community tended to promote educational success in schools. Similarly, Coleman (1987) describes the "social capital desert" that some students live in. Ravitch (2010) makes the same point by addressing the issue of school failure and high dropout rates exist only in areas of racial and economic isolation of schools. This is an illustration of the problem Coleman (1987) predicted in 1987 and Lareau (2002) and Epstein and Dauber (1997) continue to describe in their writings about adult peer influence today.

In his study of the South Bronx neighborhood in New York City, Kozol (1995) classifies this type of racial and socio-economic isolation he witnesses as hyper segregation. Kozol (1995) illustrates his point by noting that in Public School 65, in a total school population of 800 students, there was one white student. He goes on to note that this school is not the exception, but rather the rule in public schools in the South Bronx. Kelly (2004) determined that part of the reason social class advantage exists is because higher social class students attend schools with more academic course offerings and enrollments; social class segregation at the school level increases the course-taking gap because of this difference.

The 2010 Condition of Education report (Aud, et al., 2010) statistically illustrates the phenomenon described by Kozol (1995) and Ravitch (2010). The report looked specifically at high poverty schools in the United States, in relation to all other public schools. For the purposes of the analysis a high poverty school was classified as a school in which 76 – 100 percent of all students in attendance qualified for the federal free or reduced lunch program. The findings showed that 40% of all public elementary schools located in a city are high poverty, and 20% of all city public high schools are also high poverty. Additionally, the scores on the NAEP reading and mathematics exam in 8th grade indicate that students attending high poverty schools experience a significant achievement gap, compared to students from low poverty public high schools. Based on previous discussions of parental involvement and school achievement, this gap may be partly attributed to the lack of parental connoisseurship occurring among students attending these high poverty schools.

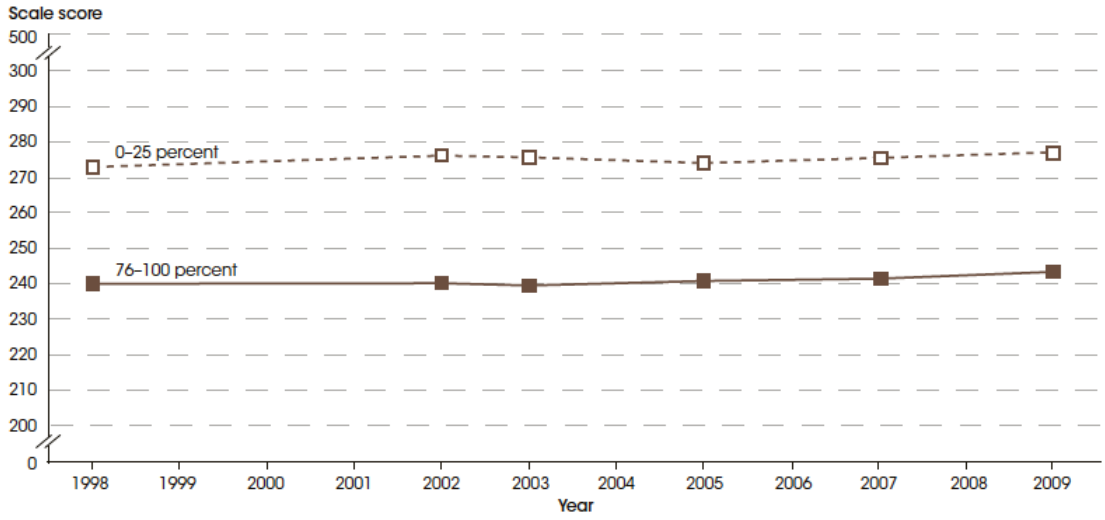

Figure 2. Reading Standard Scale Scores by Percent of Students Receiving Free or Reduced Lunch

Source: Aud, S., W. Hussar, M. Planty, T. Snyder, K. Bianco, M. Fox, L. Frohlich, J. Kemp, & L. Drake. (2010). *The Condition of Education 2010* (NCES 2010-028). National Center for Education Statistics, Institute of Education Sciences, U.S. Department of Education. Washington, DC.

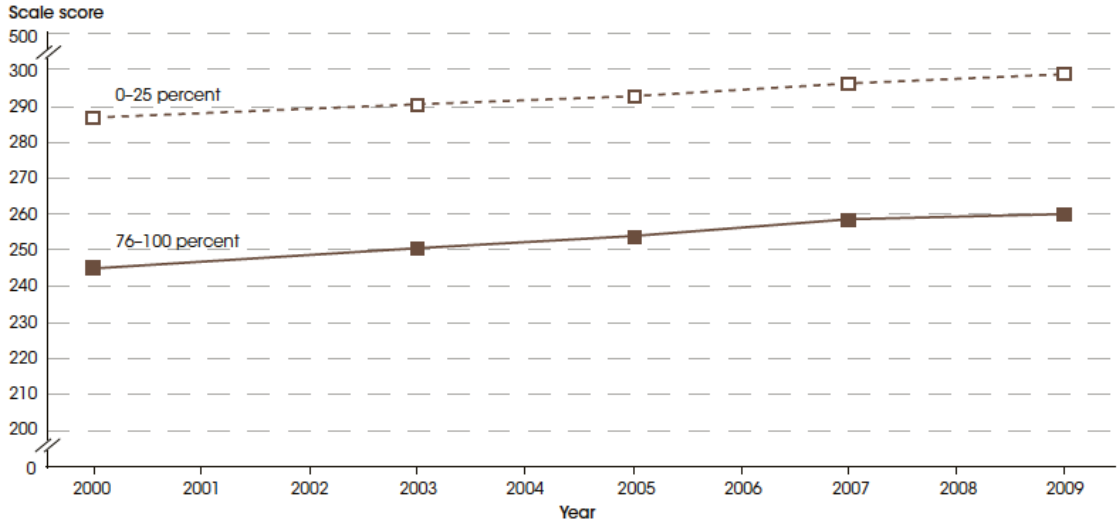

Figure 3. Mathematics Standard Scale Scores by Percent of Students Receiving Free or Reduced Lunch

Source: Aud, S., W. Hussar, M. Planty, T. Snyder, K. Bianco, M. Fox, L. Frohlich, J. Kemp, & L. Drake. (2010). *The Condition of Education 2010* (NCES 2010-028). National Center for Education Statistics, Institute of Education Sciences, U.S. Department of Education. Washington, DC.

Further, in the NCES data analysis of the 100 largest public school districts in the United States, we find that 13% of these school districts are high poverty, 15% of the districts are racial segregated (meaning a minority population of at least 90%), and 7% of these districts are both racial segregated and high poverty schools.

The report *Are We Losing the Dream?* (Frankenburg, Lee, & Orfield, 2003), looked at the effects of school resegregation and school achievement. Their findings are similar to that of Coleman (1987), Ravitch (2010), and Borman and Dowling (2010), in that children attending high poverty schools experience a lower quality of education. They also find that minority children are much more likely to attend these schools and, in turn, have access to less experienced teachers, poor classroom resources, and poor building conditions. This graphic shows the racial composition of public schools, by poverty status of the school:

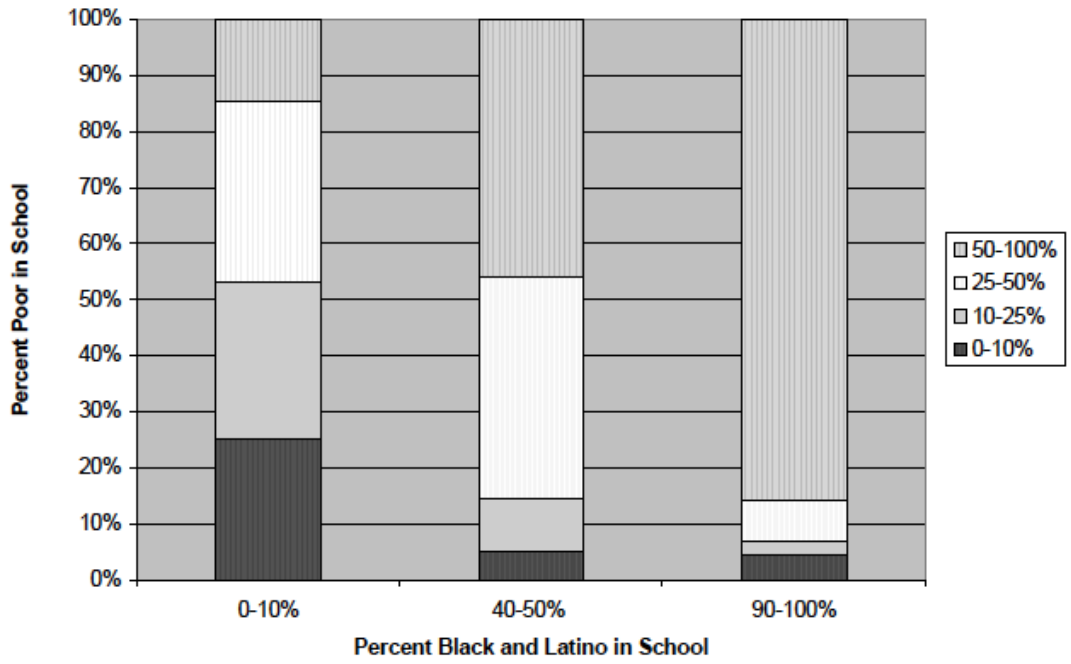

Figure 4. Racial Composition of Public Schools, By Poverty Level

Source: Frakenburg, E., C. Lee, & G. Orfield. (Jan., 2003). A multiracial society with segregated schools: Are we losing the dream? *The Civil Rights Project.* Harvard University. Cambridge, MA

One of the most common forms of indirect parental connoisseurship is the expectations parents have for their students including their expectations after graduation. Parents may convey their expectations for their students, either through conversations with their students explicitly about course placement and academic performance, by modeling behavior that supports the importance of schooling, or by talking to students about their own academic experiences while in school.

Tyson (2011) interviewed minority students about their track placements and course selections in high school. Many of the students from low socio-economic backgrounds indicated that their parents or other family members had, at some point in time, expressed regret over not working as hard as they could have in school, or pursuing

an education past the 12th grade. Additionally, she found that lower income and working class students felt pressure from their surroundings to succeed in school in order to achieve the upward social mobility that their parents were unable to attain. She did not find, however, that these students or their parents blamed the school for treating them unfairly or placing them in lower tracks because of their race or socio-economic status.

In many cases, when parents shared their economic hardships with their children, the students felt that it was their responsibility to achieve some upward mobility for their family's benefit. In contrast to their middle and upper class counterparts, these children did not have the help from their families in terms of academic experience or help navigating the social norms of the school, but they were equipped with high expectations to work hard and succeed in school. Marjoribanks (2002) also found that parents from low socio-economic backgrounds tended to have high expectations for their students in school, in some cases their aspirations for their children were higher then the ones set by middle and upper class parents. However, because of their lack of postsecondary education themselves, these parents were unable to help their students navigate the school system in a way that might produce some obvious positive effect. Similarly, Hill et al. (2004) found that parents from low socio-economic status backgrounds typically do not become involved in their children's school in ways that enhance or change school behavior or performance. However, this type of parent involvement may communicate their expectations for their child's future success and upward mobility.

Conversely, Crosnoe, Mistry, and Elder (2002) found that parents from economically disadvantaged backgrounds tend to be more pessimistic about the chances that their children will be able to attend college in the future. Which made them less

motivated than their upper and middle class counterparts to help their middle and high school students make course decisions in secondary education. They found that this sense of pessimism tended to enter into conversations about schooling, sending the message to students that regardless of their course taking decisions or academic performance, they would not be able to attend college or do well in school because of their socio-economic background or other life experiences. Similarly, Battin-Pearson, et al. (2000) found that parent expectations for their students in school are closely related to their own educational experiences in school. In contrast to the parents in Tyson's (2011) study, who largely blamed their lack of academic success on themselves instead of the school, Battin-Pearson et al. (2000) found that parents tended to convey the message to their children that their experience in school would be like their own. Hill, et al. (2004) also determined that children from lower socio-economic backgrounds were more likely to model their parents' lower levels of educational attainment. In many cases, low socio-economic status families have not experienced the benefits of earning a quality education, both during their K – 12 schooling experience and after high school, thus making it harder for them to portray or understand the importance of a quality education to their children.

Another disadvantage many low and working class parents have when trying to talk to their children about educational opportunities, especially in middle and high school, is the access to information about their course taking options. Since more and more schools are removing course taking restrictions in high school (Lareau, 2002; Oakes, 2005; Tyson, 2011), particularly in traditionally tracked courses like mathematics and science, information is provided to students and parents and they are expected to be

able to read the information and make decisions for future plans after high school. Parents from low socio-economic backgrounds tend to have less education than their middle and upper class counterparts, and were also likely to be placed in lower track academic courses in high school. Given their K – 12 schooling experience, many of these parents do not have experience in reading academic material to select the course most appropriate for their student, nor do they have experience in some of the upper level courses being described in the literature provided to the families. Eccles, Vida, and Barber (2006) found that mother's education level was a more accurate predictor of student course enrollment, than was socio-economic status. This finding illustrates the idea that when parents can draw on their personal educational experience, they were able to access institutional knowledge that would help their children make informed academic decisions.

McFarland and Rodan (2009) found that students from low socio-economic status backgrounds may have a hard time getting access to course information and making sense of all the information provided to them. Because of this difficulty, they assert that course decisions are already made for the students, even though they appear to be left up to the decision of the student and their family. Similarly, Crosnoe and Schneider (2010) found that school officials also were more likely to discuss mathematics course taking options with students from middle and upper class backgrounds, thus giving students from lower and working class families a decided disadvantage in the course selection process. Additionally, they noted that students with low achievement on mathematics tests were more likely to take higher-level mathematics courses at the beginning of high school when they were able to talk about their mathematics course taking patterns with

parents and school officials. These discussions also led to students accumulating more mathematics credits than their equally low-scoring peers by the end of high school.

Lee and Bryk (1988) also highlight the importance of school officials taking the place of parent course knowledge. In a study of student course taking options they found that when students are left to make curriculum tracking decisions on their own they do not have the foresight or knowledge to decipher the implications of their middle school course selection decisions. Regardless of social class, students without the appropriate guidance from home or school officials tended to enroll in academic tracks that did not match up with their educational goals at the end of their K – 12 schooling experience, thus making knowledgeable adult intervention much more important in the academic lives of students. According to Hill, et al. (2004), lack of guidance and support from parents was the primary reason talented, low income, middle school students were less likely to attend college, despite their parents' aspirations.

In contrast, many students from middle and upper class backgrounds have the advantage of parents who obtained an education after high school and understand the importance of continuing their education after graduation. Because of this, the conversations parents have with their children, with regard to schooling and the course selection process are more focused in comparison to the conversations parents from low socio-economic backgrounds are able to have with their children. In essence, the experience of obtaining a postsecondary education changes the conversation between parents and students, because these parents may have the "inside track" to helping their students be prepared for schooling after high school. In cases when middle and upper class parents have not had the personal experience of attending colleges or do not know

the answers to correct course placement decisions for their students Lareau (2004) and Lareau and Cox (2011), find that these parents know people in the community they can direct their children to for extra help. Many times middle and upper class families live in neighborhoods where a neighbor or coworker might have the knowledge the family is missing and they have the social connections to obtain this information. Lareau (2004) also found that middle and upper class parents were often times friends with school officials outside of the school setting and could obtain information through casual conversation in social settings. These were resources that lower and working class parents did not have access to as readily as middle and upper class parents because of the social groups they tended to work with and live around.

Reigle-Crumb and Grodsky (2010) found that parents from advantaged backgrounds usually have more familiarity with the educational system. This familiarity equips the parents to provide their students with more useful information about navigating the school system and enabling their children to enroll in courses that will serve them better for academic success and postsecondary schooling. Similarly, Crosnoe and Schneider (2010) assert that parents from middle and high socio-economic backgrounds tended to speak with their children more frequently and more specifically about mathematics course taking options in high school. They also found that these conversations were positively correlated with students enrolling in mathematics courses to help prepare them for college level mathematics.

According to Eccles, Vida and Barber (2004), when parents were able to have specific course selection conversations with their children in 8th grade, the children were more likely to enroll in course work in high school that would prepare them for

postsecondary education options. Additionally, parent education level, which is commonly correlated with socio-economic status, has been shown to influence student course-taking sequences, as well as early college planning (Eccles, Vida, & Barber, 2004). Specifically, parents with college educations are likely to prevent their children from enrolling in high school mathematics course sequences that do not include both geometry and algebra II (Stevenson, Schiller, & Schneider, 1994).

Indirect parental connoisseurship also plays out in children's lives, in the ways their families participate in, and select experiences outside of the realm of school. For example, in Lareau's (2002) description of concerted cultivation, she points to the extra, organized activities parents select for their children. By enrolling students in out of school experiences, such as music lessons, athletic activities, and foreign language classes; parents are reinforcing both academic skills, as well as social skills, that will serve their children well in a school setting. Another way family activities have been shown to influence their child's activities in school are the activities families choose to engage in, or enroll their students in during the summer months or other breaks when school is not in session.

Studies have shown that a child's activities throughout breaks from school account for at least some of the achievement difference between students from different socio-economic backgrounds during the school year (Alexander, Entwisle, & Olson, 2001; Caro, McDonald, Planck, & Willms, 2009; Entwisle, Alexander, & Olson, 1997). Entwisle, Alexander, and Olson (1997) found that students from working and low class backgrounds tend to gain more ground, in terms of achievement scores in reading and mathematics during the school year when compared to their middle class peers. They

contend that the large achievement gap between students of varying socio-economic backgrounds can be attributed to two things. First, the disparities in achievement that already exist at the schoolhouse door prior to kindergarten (This is also shown through achievement data analyzed by Lee (2005)), and second the activities families select for their children during the summer months and school breaks.

Discouragingly, enrolling working and low class students in summer academic programs has not shown to make large gains in the summer achievement loss experienced by these students. The researchers hypothesize that this lack of achievement by students from lower socio-economic backgrounds could be due to the nature of the activities offered to students in these summer programs. Many times the summer programs are used as remediation for skills that should have been learned during the previous school year. Also, these classes tend to be four to six weeks in length and do not vary largely from the school experience these students have during the school year. In contrast, summer activities middle class families engage in tend to be varied (for example, going to the zoo, taking swimming lessons, visiting relatives in another region of the country) and tend to be ongoing (that is parents do not have 6 weeks of structured interaction with their children). Entwisle, et al. (1997) hypothesized that the forced nature of the summer programs for low and working class students, may take away from the spontaneous nature of enriching experiences. Additionally, the experiences tend not to be ones that might spark a child's interest in a particular subject area, and in turn lead to a renewed motivation to achieve in the school environment. Also, wealthy families can use financial assets for resources that might help with educational success. Families with more financial resources can afford to send their children to expensive elite schools, buy

houses in desirable school districts, or pay for out-of-school tutors (Marks, Cresswell, & Ainley, 2006).

Conclusion

These three ideas (track placement, mathematics course-taking, and parent involvement) create a synergistic effect that impacts the school experiences of children. The importance of mathematics course taking throughout a child's school experience indicates that all children could benefit from quality mathematics instruction during their K – 12-school experience. Although not all students achieve in mathematics (or any course subject) at the same level, a vast body of research has shown that placing students in lower mathematics tracks may inhibit his or her learning of school mathematics. The lowered expectations and teaching practices, coupled with the lack of involvement from parents, and lack of support from peers; disproportionately places students from low-income backgrounds in these lower mathematics tracks. Thus, the students who may be able to benefit from a quality school experience the most, are the ones who are being denied a quality education, in comparison to their upper and middle class counterparts.

Although a variety of factors may play in to track placement of students, one of the most important considerations when placing students in school tracks is parent involvement. That is, sometimes, regardless of a child's ability in a particular subject area when parents become involved in both the life of the school and the child's track placement, the placement of students almost always results in the child being placed in the most favorable track in terms of teacher practices, expectations, and the child's own expectations of success or future plans.

It is the responsibility of the school to both empower parents and students to make well informed decisions about track placement, particularly placement in to mathematics track, and to ensure that regardless of the track the child is placed in each child receives a quality education. The quality of the child's education should be divorced from the child's social background and level of parent involvement.

CHAPTER III: METHODOLOGY

The issue of poverty is not a statistical issue. It is a human issue.

James Wolfensohn

Rationale for the Study

Wang (2004) and Crosnoe and Schnieder (2010) served as the main frameworks to inform this study. Crosnoe and Schneider used the data collected from the 1988 National High School transcript study in order to relate a student's socio-economic status, mathematics course enrollment, and conversations students had with various stakeholders, related to mathematics course enrollment and achievement in eighth and tenth grade. They used both a regression analysis and three-way ANOVA to describe the way parent/teacher/friend expectations and conversations might impact both course enrollment and mathematics achievement in eighth and tenth grade. Similarly, Wang (2004) considered a list of parent behaviors and correlated them with student achievement scores in Japan and the United States. She was interested in comparing parent behaviors in the two countries and the way they played out in terms of mathematics achievement on the 2003 TIMSS assessment. For this study, I use the idea of specific parent activities (Wang, 2004) and the interaction between parent behaviors and mathematics enrollment (Crosnoe & Schneider, 2010) to lay the groundwork for my study of parental connoisseurship and mathematics course taking in high school.

Rationale for the Design of the Study

This study uses quantitative methods to analyze the data set available from the National Center of Education Statistics 2009 High School Longitudinal Study (Ingles, et al., 2011). Because of the amount of data collected as part of the High School

Longitudinal Study the use of quantitative methods is an appropriate way to analyze the data. The purpose of this study is to address the following questions:

1. What relationship does parental connoisseurship have with the mathematics course-taking decisions of school children?
2. Do middle and upper class parents, regardless of race or ethnicity, engage in connoisseurship behaviors more than their lower and working class counterparts?
3. Is there a profile of characteristics to a particular form of connoisseurship that explains the mathematics course taking decisions of school children?

Research Instrument

The survey used for this study was designed by the National Center for Education Statistics. I used the public access data for this study, meaning that some factors identifying the study participants were not available for my use. Additionally, all information collected for the study was aggregated at the student level. Four surveys were used as part of the overall High School Longitudinal Study, including surveys to be filled out by 9th grade students, school counselors, school administrators, and parents of the 9th grade students selected for the study. Additionally, students participating in the study took an online Algebra assessment. Because the focus of my research is on parental connoisseurship, I only looked at the survey responses from the Parent Questionnaire. These survey results were matched with their child's academic records for their 9th grade course-taking patterns.

The parent survey is organized in to six sections; Family Structure, Family's Origin and Language, Parent's Education and Occupation, Previous Educational Experiences, Parent's Involvement, 9th Grader's Future. Information about the family's

socio-economic status was obtained from the introduction of the survey, all survey responses from the Parent's Involvement section were considered for this study. (See Appendix B).

To obtain information about the family's socio-economic status NCES considered five variables. The variables included:

1. The highest education among parents/guardians in the two-parent family or the education of the sole parent/guardian.
2. The education level of the other parent/guardian in the two-parent family.
3. The highest occupation prestige score among parent/guardians in the two-parent family or the prestige score of the sole parent/guardian.
4. The occupation prestige score of the other parent/guardian in the two-parent family.
5. Family income, reported as a continuous variable, or as a categorical variable.

The questions in the Parent's Involvement section of the survey consisted of a series of yes-no questions, multiple-choice responses, and three questions in which parents indicated which activities they had engaged in with their children in the past school year.

Information about the student's 9th grade mathematics course enrollment was reported by the students on the student survey. Students were instructed to select all the mathematics courses they were currently enrolled using the following options; Algebra I, Geometry, Algebra II, Trigonometry, Review/Remedial Mathematics, Integrated Math I, Statistics, Integrated Math II, Pre-Algebra, Analytic Geometry, Advanced Mathematics, no mathematics course enrollment, and Other.

Selection of the Participants

Students were selected to participate in this study through a 2-stage identification process. First, 1,889 schools were selected from a stratified random sample of school districts in the United States. Nine hundred forty four schools agreed to participate in the study. Then, students from each of the identified schools were randomly selected for participation in the study. This process resulted in 25,206 students participated in the study (27 students per school). Because of language barriers or severe disabilities, 548 were deemed unable to complete the student questionnaire. However, contextual data were still collected for each of these students (Ingles, et al., 2011).

Parents who completed the questionnaire were selected because their students had been identified to participate in the study. Only one parent completed a survey for each student. Parents chose which parent would complete the questionnaire. The instructions to the parents indicated that the parent who was most involved in their 9th grader's schooling should complete the survey. Of the 25,205 eligible parents, 16,995 (or 67.5%) of parents completed the parent questionnaire for their 9th grade child. Parents were given the option to complete the survey either online or by phone interview. Parents taking the survey were advised that the survey would take about 32 minutes to complete. Parents not wanting to complete the full survey were given the option to complete an abbreviated survey, taking about 16 minutes to complete. Parents who were still not willing to complete the survey were offered $0, $10, and $20 to complete the full or abbreviated form of the survey. Non-response bias tests were run to by NCES, the results of the tests found that the non-response bias for home-life and the parent questionnaire were negligible (Ingles, et al., 2011).

Data Analysis

A two-factor design was used to measure the influence of parental connoisseurship on mathematics course taking. I chose to use the two-factor design for a variety of reasons. First, by using a two-factor design I could control for a student's socio-economic status. I could also account for the variety of ways parent responses on the surveys were measured. For this study, I was most interested in the interaction effects between parent activities and the socio-economic status of survey participants. I was also interested in the main effects of Factor A (parent activities). Previous research indicates that there is a strong main effect of Factor B (socio-economic status).

The National Center of Education Statistics reported participant's socio-economic status levels as quintiles. The students in the lowest quintile were assigned a socio-economic status score of 1, middle low = 2, middle = 3, middle high = 4, high = 5.

Because of the widely noted "Catholic school effect," (Borman & Dowling, 2010; Coleman, 1987; Willms, 2003). I chose to omit all student and parent responses from children who attended Catholic and private schools in 9^{th} grade (the collected data did not differentiate between Catholic and other private schools). A total of 3,933 surveys were omitted because they were from private or Catholic schools. The "Catholic school effect," speaks to the limited number of courses offered in a school setting, thus eliminating the number of tracks available to students in high school. Additionally the Catholic school effect notes the impact that a close knit community of parents, students, and teachers can have on students from backgrounds with parents who are not involved in the lives of their children. Because the focus of this project is to try to identify parent behaviors that lead to higher level mathematics course enrollment, I thought both of these

factors associated with Catholic school attendance would not accurately portray the influence that parents have over mathematics course-taking in this setting.

I also omitted surveys of students who did not indicate their 9th grade mathematics course placement and surveys of students whose parents either did not complete any part of the parent questionnaire or who completed parts of the parent questionnaire, but did not complete the Parent Involvement section of the parent questionnaire. I also did not include research participants whose parents only completed part of the Parent Involvement section of the questionnaire. I decided to omit the partially completed parent questionnaires because the National Center for Education Statistics did not recommend imputing data for any variables measured in the Parent Questionnaire part of the survey (Ingles, et al., 2011).

The sample of research participants totaled 21,445; 16% of the total sample consisted of the lowest quintile socio-economic background, 17.3% were from the low middle quintile, 19.7% from the middle quintile, 21.2% were from the middle high quintile, and 25.7% were from the highest socio-economic status quintile. After omitting the surveys described above I was left with 10,968 study participants. About 18.3% of this sample made up the lowest socio-economic status quintile, 18.4% were from the lower middle quintile, 18% from the middle quintile, 18.8% from the middle high quintile, and 25.6% of the student participants were from the highest quintile.

I divided mathematics course-taking patterns into 3 categories; standard, midlevel, rigorous. Each level was assigned a value of 1 – 3. Standard level course taking = 1, midlevel = 2, and rigorous = 3. These levels are defined by Nord, Roey, Perkins, Lyons, Lemanski, Brown, & Schuknecht (2011) as follows; a student in the

standard mathematics track has earned 3 credits in mathematics throughout their high school career, but none of the credits earned are past Geometry. The midlevel course-taking pattern includes Geometry and Algebra II course taking, as well as earning at least 3 credits in mathematics. Rigorous course taking is defined as enrolling in one other mathematics course, beyond Geometry and Algebra II, as well as earning at least 3 credits in mathematics. McClure (1997) makes the distinction that years of mathematics course taking should not be the only determining factor when considering the level of course taking. Since schools offer a variety of mathematics courses, it is possible for students to take 4-years of mathematics classes and still not enroll in any class beyond Geometry. (Kelly, 2007) also makes note of this phenomenon as a way schools have responded to increased Carnegie Unit requirements for graduation in mathematics).

Nord, Roey, Perkins, Lyons, Lemanski, Brown, & Schuknecht (2011) defined these levels of mathematics course-taking as a way to classify a student's academic level at the end of their high school career. In other words, the levels of standard, midlevel, and rigorous were used when looking at a four-year pattern of course taking. Because I only have access to freshman year course enrollment, I used freshman-level courses to classify students according to where their entrance in the mathematics pipeline might take them and because the majority of states require 3 Carnegie Units in mathematics for graduation, I used a student's starting mathematics placement and projected their placement in mathematics at the end of 3 years of mathematics course taking. For the purposes of my study students enrolled in Pre-Algebra, Remedial/Review Mathematics, or Other as freshman were considered to be at the standard level of mathematics course-taking; students starting in Algebra or Integrated Mathematics I enrolled in a mid-level

course-taking pattern, and those students enrolled in Geometry, Algebra II, Integrated Mathematics II, Advanced Mathematics, Statistics, or Analytic Geometry were considered to be taking mathematics at the rigorous level as freshman. Students who reported not being enrolled in a mathematics course at all during their freshman year were assigned a value of 0. Some students reported that they were enrolled in more than one mathematics course during the fall of their freshman year. Students enrolling in more than one course were assigned the value associated with the most advanced course reported.

The first variable considered for this study was parent responses to the question "Is your 9th grader's school assigned or chosen?" A 2 x 5 two factor designed was used for this test, in which the responses "assigned" was one column and the responses "chosen" or "assigned, but would have selected this school," were the columns (the A factor) and the five socio-economic status levels were the rows.

The next variable was parent responses to the question "Since the beginning of the school year have you or other adults in your household . . ." A list of seven items follows. The seven items include; attending a general school meeting, attending a meeting of the parent-teacher organization, gone to a regularly scheduled parent-teacher conference, attended a school or class event such as a play, dance, sporting event, or science fair; served as a volunteer in the classroom or somewhere else in the school, participated in fundraising, or met with the school counselor. These measured direct parental connoisseurship actions and were labeled as such. A 3 x 5 factor design was used, in which the ranges 0 – 1, 2 – 4, 5 – 7; indicating the number of "yes" responses were the columns.

Next, parents indicated how often they helped their children with homework. The responses on the survey were broken up into the following ranges; "never," "less than once a week," "1 or 2 days a week," "3 or 4 days a week," "5 or more days a week." Parents helping their children "never" or "less than once a week," were one column for the 2-factor ANOVA, "1 or 2 days a week" and "3 or 4 days a week" were another column, and "5 or more days a week," made up the third column. Parents were also asked about how confident they feel in their ability to help their child with mathematics homework. The response choices were "very confident," "somewhat confident," "not at all confident." These were the columns in the next 3 x 5, 2-factor test.

Parents were also asked to indicate their beliefs about student performance in mathematics based on gender. Parents could select from the responses, "Females are much better," "Females are somewhat better," "Females and males are the same," "Males are somewhat better," "Males are much better." The responses "females are much better" and "females are somewhat better," were one column for the test, "females and males are the same," was one category for the 2-factor test, and "males are somewhat better" and "males are much better" were the final category for this 2-factor test. Parents indicated extracurricular activities their child had participated in, outside of school. These 9 activities included; music, art, dance or theater; organized sports supervised by an adult, religious youth group or religious instruction, scouting or another group or club activity, academic instruction outside of school such as a Saturday Learning Academy, personal tutor, or summer school program; a math or science camp, or another camp. There were 9 responses, including "none of these." Parents could select all that applied, so the A factor categories for this test were ranges of activities, including; "none of these – 1 activity, 2 –

4 activities," and "5 – 7 activities." I labeled this group of activities as indirect/passive parental connoisseurship. Finally, parents were asked about the types of activities they had participated in with their child in the last year. These activities included trips to the zoo, visiting a library, working or playing on a computer together, building or fixing something together, attending a school science fair, working on a science fair project together, discussing a program or article about mathematics or science, and going to a live show together. There were 9 responses listed, including "none of these" and parents were instructed to select all that applied. I labeled this group of activities as indirect academic parental connoisseurship. The ranges of responses were grouped as; "none of these – 1", "2 – 4 activities," and "5 – 8 activities."

I decided to use additional descriptive statistics in order to describe specific parent behaviors that may result in upper level mathematics course enrollment as freshmen. I decided to look at the mean and standard deviation for all parent behaviors listed among the 7 survey questions. For these statistics, I calculated average course enrollment for all socio-economic backgrounds. I used these averages identify enrollment level disparities by socio-economic status.

I used an alpha level of .05 to test for significance. With an alpha level of .05 and a sample size of 10,968 the power of my statistical test is 81% (Statistical Power Calculator, 2010). Typically any statistical test with power greater than 80% is acceptable (Gatti & Harwell, 1998). Originally, I had planned to use an alpha level of .10 since the study is strictly exploratory and the implications of a Type I error are not serious. The results of a Type I error would indicate that a particular parent behavior may encourage upper level course enrollment, when in fact it does not. As a result of a

Type I error parents might be encouraged to engage in this behavior with their child, even though it does not have an effect on upper level mathematics course enrollment. This result would not end up being expensive, nor would it harm the parent or child. However, because I am running 7 statistical tests, I decided to adjust the alpha level to .05. The purpose of this study is to find parent behaviors that may lead to persistence in upper level mathematics course enrollment in high school. By allowing the alpha level to be more restrictive, the 2-factor tests are more sensitive to finding potential parent behaviors that may lead to higher-level mathematics course enrollment. This may indicate areas for further study, related to parent connoisseurship and mathematics course taking.

Limitations

There are a few limitations to this study. The first being the non-response bias that may be experienced in the collection of parent survey data. Because the purpose of this study is to identify parent behaviors related to course taking, it is reasonable to assume that parents not completing the survey may not be as involved in their child's schooling. Students who did not have accompanying parent data were not included in this study because of the way it was designed, so data about students with seemingly less involved parents may not be included. Additionally, by eliminating survey participants whose parents did not fill out a complete survey, I may have inadvertently eliminated a particular subset of study participants. I tried to account for this by making sure the proportion of socio-economic background was similar for the entire sampling population as well as my subset.

The second limitation of this study involves the use of 9th grade course-taking data in order to indicate the level of mathematics course enrollment. Although research exists speaking to the lock-step nature of mathematics course-taking (for example, Kelly (2007) and Chazan (2000)) by projecting student course-taking, I am unable to account for those students that may move more quickly through the mathematics pipeline or drop out of the pipeline earlier than expected.

Because of the way I have organized the data for this study, I am unable to identify whether it is the accumulation of parental behaviors that result in their children enrolling in upper level mathematics in high school, or whether it a specific parent behavior may have this same effect. By looking at means for each parent activity, I am able to identify areas that might be appropriate for further study, however I am unable to indentify whether or not these particular parent behaviors result in upper level course enrollment because parents from higher socio-economic backgrounds engage in these activities more often, or if the activity, regardless of the parent background leads to students enrolling in upper level course work.

Finally, a social desirability biased might be unaccounted for in the way these statistics were collected. That is, some parents may have indicated that they participated in more activities with their child than they actually did because they want to appear to the people conducting the survey that they are good, involved parents. This may also be more likely to happen since more than half of the data for this study was collected through the process of a phone interview.

CHAPTER IV: RESULTS

Overcoming poverty is not a task of charity, it is an act of justice.

Nelson Mandela

The analysis of the data for this study is divided into three parts. First, I address the relationship between parental connoisseurship and mathematics course-taking decisions of school children. Second, I use the collected data to address the frequency with which parents from differing socio-economic backgrounds engage in parental connoisseurship. Finally I consider the types of parental connoisseurship (direct and indirect) and the profiles of parents engaging in such activities.

Parental Connoisseurship and Mathematics Course-Taking Decisions

Passive Indirect Parental Connoisseurship

I used seven different measures of parental connoisseurship for this study. One type of particular parental connoisseurship was shown to significantly interact with mathematics course enrollment and socio-economic status background at the .05 level.

Table 1. Two-factor ANOVA for Passive Indirect Parental Connoisseurship

Source	Sum of Squares	d.f.	Mean Square	F	Sig.
SES Quintiles	526.301	4	131.575	171.690	.000
Passive Indirect PC	24.103	2	12.052	15.726	.000
SES by Passive	14.143	8	1.768	2.307	.018
Error	8374.696	10928	.766		

The frequency with which parents engage in behaviors in the category "Passive Indirect Connoisseurship" are likely to have some influence on a student's mathematics course enrollment. The activities parents enroll their children in, in this category of responses include: music, art, dance or theater; organized sports supervised by an adult, religious youth group or religious instruction, scouting or another group or club activity, academic instruction outside of school such as a Saturday Learning Academy, personal tutor, or summer school program; a math or science camp, or another camp.

Moreover, it seems that the frequency with which parents engage in this type of connoisseurship plays out differently in terms of level of mathematics course taking with children from differing socio-economic status backgrounds. The descriptive statistics and the graph of the means for this category, show that the number of behaviors associated with connoisseurship, may impact the mathematics enrollment levels of students in different ways across socio-economic levels.

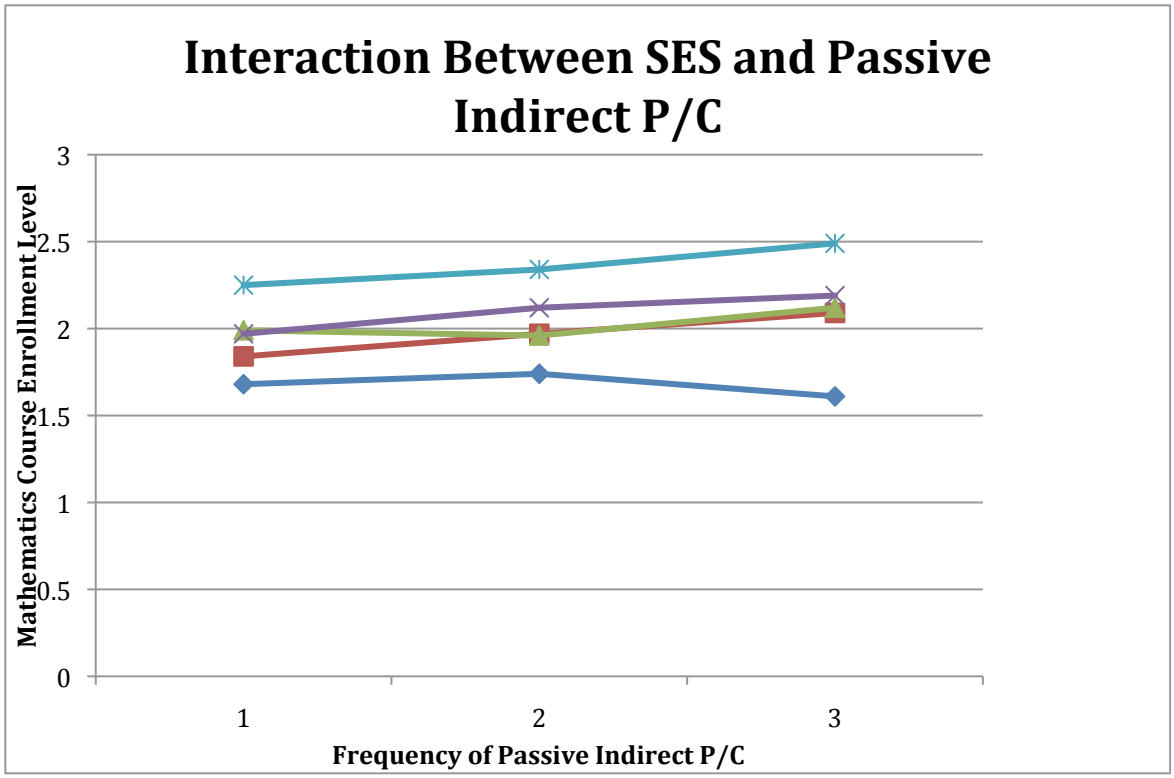

Figure 5. Passive Indirect Parental Connoisseurship.

Table 2. Descriptive Statistics for Passive Indirect Parental Connoisseurship

SES Quintiles	Passive Indirect PC Frequency Levels	Mean	Std. Deviation
1	1	1.68	.945
	2	1.74	.924
	3	1.61	.970
	Total	1.70	.938
2	1	1.84	.866
	2	1.97	.854
	3	2.09	.830
	Total	1.91	.862
3	1	1.99	.859
	2	1.96	.894
	3	2.12	.827
	Total	1.98	.878
4	1	1.97	.896
	2	2.12	.857
	3	2.19	.836
	Total	2.08	.871
5	1	2.25	.874
	2	2.34	.840
	3	2.49	.778
	Total	2.34	.844

Note: Measure of Indirect Parental Connoisseurship described in Chapter III.

Notice that, according to the collected data, as students from the middle low (SES 2), middle (SES 3), middle high (SES 4), and high (SES 5) socio-economic status backgrounds enroll with greater frequency in activities listed as Passive Indirect Parental Connoisseurship, the mean level of freshman mathematics course enrollment increase.

The simple main effects follow up to this test also indicate a significant difference in level of course enrollment between levels of frequency of Passive Indirect Parental Connoisseurship behaviors for quintiles 2, 4, and 5 of socio-economic status.

Table 3. Simple Main Effects of Passive Indirect Parental Connoisseurship

SES Quintiles	Sum of Squares	d.f.	Mean Square	F	Sig.
1	1.919	2	.960	1.252	.286
2	11.071	2	5.535	7.223	.001
3	1.869	2	.934	1.219	.295
4	11.904	2	5.952	7.767	.000
5	11.483	2	5.742	7.492	.001

Table 4. Pair-wise Differences for Simple Effects

SES Quintile	SES Quintile (I)	SES Quintile (J)	Mean Difference (I-J)	St. Deviation	Sig.
1	1	2	-.053	.040	.183
		3	.075	.112	.506
	2	3	.128	.114	.262
2	1	2	-.133	.040	.001
		3	-.255	.104	.014
	2	3	-.122	.104	.237
3	1	2	.029	.041	.479
		3	-.125	.105	.234
	2	3	-.154	.103	.137
4	1	2	-.153	.042	.000
		3	-.222	.083	.008
	2	3	-.069	.080	.389
5	1	2	-.095	.041	.021
		3	-.246	.064	.000
	2	3	-.151	.057	.008

For students from the middle-low and middle-high quintile of socio-economic status, the follow up test for simple main effects indicated that the difference in course level enrollment when students participate in 2 – 4 activities, or 5 – 7 activities, is significantly higher than the students in the same quintile who participated in 0 – 1 of these activities. For students in the highest quintile of socio-economic status the difference in course level enrollment is statistically significant when students participate in 2 – 4 and 5 – 7 activities, compared to students participating in 0 – 1 activities. Students in the highest

quintile of socio-economic status who enroll in 5 – 7 activities, compared to 2 – 4 activities also enroll in a significantly higher level of mathematics coursework.

These tests speak to the phenomenon of Concerted Cultivation (Lareau, 2002), in which Lareau argues that parents who understand the importance of social capital and the way it relates to their child's school experience carefully select their child's out of school experiences. In particular, they are careful to select experiences that reinforce social characteristics that will serve them well in navigating their school experience. Lareau (2002) argues that parents from middle and upper class social backgrounds participate in concerted cultivation more frequently than their lower income counterparts and that upper income parents are adept at selecting activities that translate in to success in the school setting. The findings from this study support Lareau's (2002) claim that parents from higher income backgrounds may engage in these types of activities more frequently. In fact, only 3% of parents from the lowest quintile of socio-economic status responded that they enrolled their child in 5 – 7 of these activities in the last year. In comparison, nearly 10% of the parents from the highest socio-economic status quintile indicated that they had enrolled their child in 5 – 7 of the Passive Indirect Parental Connoisseurship activities in the past year. The mean levels of mathematics course enrollment also support Lareau's (2004) finding that among students from higher socio-economic status backgrounds, participation in these activities seems to positively impact their mathematics course enrollment decisions.

The results of the simple main effects test also indicate that the various levels of participation in indirect parental connoisseurship activities become more important, in terms of course level enrollment among students in higher socio-economic status

quintiles. In particular, the level of participation in activities results in a significant difference in level of mathematics course enrollment among the highest quintile of students for all three different activity levels.

The findings from this study may indicate that when parents from lower socio-economic status backgrounds understand the importance of selecting out of school experiences for their students, they are also able to positively impact course enrollment. It is possible that parents from lower socio-economic backgrounds who understand the importance of enrolling their students in these types of out of school experiences have more social capital than other peers from their same economic background (as shown in the follow up test for the middle-low quintile). That is even within social classes there is a type of social hierarchy, and parents who are able to navigate this hierarchy can make concerted cultivation work for them in the school lives of their children. Although enrollment at the highest level of these types of activities seems to negatively impact the level of mathematics course enrollment for students from the lowest socio-economic status backgrounds, the findings from this study indicate that some enrollment in these types of activities could still positively associate with mathematics course enrollment decisions of students from the lowest socio-economic status level. From the table and the interaction graphs, it is clear that when parents from the lowest socio-economic quintile enroll their students in 2 – 4 of these types of activities the average course enrollment increases.

The significance of a child's participation in these activities has also been discussed explicitly by Entwisle, Alexander, and Olson, (1997, 2001) and Caro, McDonald, Planck, and Willms (2009). They claim that a child's school experiences on

the weekends and during school breaks play a bigger role in the widening of socio-economic achievement gap, than does anything that happens during a child's K – 12 schooling experience. The types of experiences that Entwisle, et al. (1997, 2001) and Caro, et al. (2009) describe as being advantageous are also the experiences described in the Indirect Parental Connoisseurship part of the National Center of Education Statistics survey.

Entwisle, et al. (1997, 2001) and Caro, et al. (2009) argue that experiences such as being a member of a sports team, or going to summer camp contribute positively to a child's schooling experience because children participating in these activities are learning from experiences that are not often played out in the classroom, but that are just as important to a child's development. They also argue that through these out of school experiences children may be given other, more authentic ways to think about and aspire toward a future career. An excitement for learning or passion for a particular area of pursuit carries over to the classroom. For example, a child attending a summer day camp may discover they have an affinity for geology or the arts. This child may then be more likely to enroll in science coursework or complete coursework in school that would enable them to enroll in a post-secondary program in order to support their new found interest in a particular curricular area.

Participation in these activities also speaks to the Catholic school effect described by Coleman (1987) and Willms (2003). Both Coleman (1987) and Willms (2003) assert that even when children are raised in a home in which the parents might not have much social capital, when the children are involved in a community of other supportive adults, those children are able to benefit from the social capital of other adults and children with

whom they interact. Each of the activities listed in this particular category involve activities that put children and adults into interaction. The activities of participating in music, art, dance, or theater; organized sports lead by an adult; a religious youth group or organization; scouting or another club activity; academic instruction outside of the school; a math or science camp; or another camp all put children into meaningful contact with adults. Presumably, the adults leading each of these activities are interested in the lives of children and may be able to help fill the void for children who may not otherwise have interaction with adults who support the idea of doing well in school.

Additionally, by being involved in these activities, children are more likely to interact with other children who may be speaking with parents and teachers about post-secondary plans, and the importance of doing well in school. According to Walker, (2006) when children have "near-peers" (friends or family members a little older then them), the "near-peers" can serve as an important support system, encouraging children to do well in school. In fact, in her analysis "near-peers" served as a replacement for parental encouragement for the mathematics achievement of students. Akos, Lambie, Milsom, and Gilbert (2007) and Ryan (2001) highlight the importance of a child's friendships in terms of their course taking decisions. Akos, et al. (2007) found that children are able to use their friends and their friend's beliefs about schooling and the importance of course selection as another source of social capital. Ryan (2001) also found that as students get older and move farther along in school, they tend to take academic cues from their friends, rather then from their parents, particularly if their friends seem to have more knowledge about the school experience. In this way, students from lower socio-economic status backgrounds who may otherwise be isolated socially in their

school or neighborhood are given another way to interact with adults and students with varying educational experiences.

When parents involve their children in these types of activities they are also interacting with other adults who presumably value participation in out-of-school organized activities. This is another source of social capital not only for the children but also for the parents of children involved in the activities. Lareau and Cox (2011) outline the importance of "untying knots," for their children throughout their school experience. They describe this skill as something a parent acquires from speaking with other adults about school related issues, or by watching their parents do this for them during their school experience. Part of the reason Lareau and Cox (2011) and Epstein and Dauber (1997) argue that parents from lower socio-economic status backgrounds struggle with this is because they are not exposed to other adults who are engaging in this type of behavior. By having their children participate in organized activities with other children, such parents are also interacting with other adults from whom they may be able to take social cues about navigating their child's school experience.

Although increased participation in Passive Indirect Parental Connoisseurship activities seemed to increase the level of mathematics course enrollment for most socio-economic backgrounds of students, data from this study indicate that when students from the lowest socio-economic status quintile are enrolled in 5 – 7 of these types of activities, mean mathematics course enrollment is actually lower than the mean mathematics course enrollment of students from this socio-economic status level who are involved in none or one of these activities. In fact, from looking at the descriptive statistics for this particular set of data, it seems that students from the lowest socio-economic status quintile have the

highest level of mathematics course enrollment when they are involved in 2 – 4 of these types of activities. Possible explanations for lower mathematics course enrollment for students enrolled in none or one of these activities, follows the pattern of all other groups of students in the other four socio-economic status quintiles. However, the fact that the level of mathematics course enrollment for students involved in 5 – 7 of these activities is so much lower does not follow the established trend from the rest of the socio-economic status levels. It is also interesting to note that this finding is in line with Crosnoe and Huston's (2007) findings, that parental behaviors that had influence over a child's mathematics course taking decisions in middle and high school had virtually no effect among students from the lowest socio-economic status quartile.

Entwisle, Alexander, and Olson (1997) found that when students from low socio-economic status backgrounds are targeted for specific summer and out of school programs, meant to mimic the out of school experiences of children from higher socio-economic backgrounds, there are few, if any benefits, in terms of academic growth. They hypothesize that this is due in part to the fact that because of the programs are targeted for lower income students; the authenticity of learning through experience is compromised. That is, programs meant specifically for students from lower socio-economic backgrounds focus too much on trying to catch students up academically, and not enough on the organic type of learning that arises through lived experiences. Also, when programs are targeted towards students from lower socio-economic status backgrounds, the natural mixing of socio-economic status children and their interaction and exchanging of social capital is not likely to happen. These programs end up being

another way in which low socio-economic students and parents are isolated from students from higher economic backgrounds.

Additionally, Lareau (2004) and Kozol (1995) outline the nature of the family unit of children from poorer economic backgrounds. In many cases children are part of the day to day functioning of the household. They are expected to contribute to the survival of the family either through working after school, or by watching younger siblings so the adults in the house can go to work. Children from lower economic backgrounds play a more integral role in the functioning of the family. Because of the increased responsibility at home, it is possible that students from lower socio-economic backgrounds who are also involved in a variety of out of school activities may feel the need to enroll in a lower level of mathematics coursework because they do not have the time to contribute to their family life, participate in such a wide range of activities, and enroll in challenging mathematics coursework. In other words, low socio-economic status families with high connoisseurship levels might also be families that accord high and burdensome family expectations in the home, thereby creating a heavy obligation of responsibility for their child.

School Choice

Although the statistical test of school choice did not yield a significant result at the .05 alpha level the data suggest that school choice might have some impact on the mathematics course enrollment of freshman in high school, particularly for children from the lowest socio-economic background.

Table 5. Descriptive Statistics for School Choice

SES Quintile	Parents Chose School	Mean	St. Deviation
1	1	1.65	.934
	2	1.77	.941
	Total	1.70	.938
2	1	1.89	.869
	2	1.93	.851
	Total	1.91	.862
3	1	1.96	.851
	2	2.00	.881
	Total	1.98	.878
4	1	2.03	.879
	2	2.13	.857
	Total	2.08	.871
5	1	2.34	.842
	2	2.33	.846
	Total	2.34	.833

Table 6. Two-factor ANOVA for School Choice

Source	Sum of Squares	d.f.	Mean Square	F	Sig.
SES Quintiles	526.301	4	131.575	171.690	.000
Parents Chose School	6.872	4	131.575	171.249	.000
SES by Choice	5.940	4	1.485	1.933	.102
Error	8400.129	10933	.768		

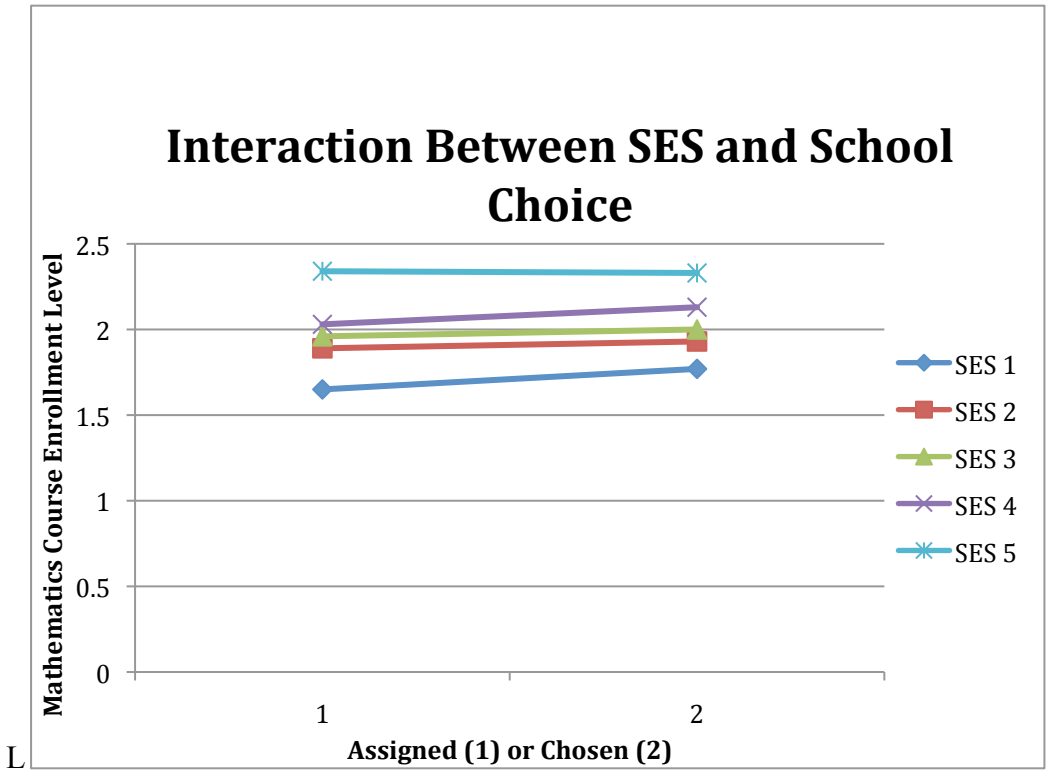

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Figure 6. School Choice

Crosnoe, Mistry, and Elder (2002), assert that regardless of race or social class, parents who chose their child's school were more likely to enroll their children in college preparatory classes. The children, in turn, were more like to stay in school, even if the parent was not involved with the school in any other way. This could be due in part to the idea that by selecting their child's public school, the parents show some interest and concern for their child's education. Even if parents do not have the social capital to effectively interact with school personnel or to talk with their children about course-taking decisions at home, parents given the option to select a school are able to identify characteristics of the school that they believe supports their child's learning.

An illustration of this fact, are the KIPP schools, which are known for high expectations and impressive academic results among low-income students. KIPP school have an attrition rate of nearly 40% for all 7th grade students. It is likely that many of these students leave the school because the school hours are longer, parents are expected to work with their children on homework, and children are also expected to complete at least 2 hours of homework every night (Ravitch, 2010). In order for low-income families to sign the contract for KIPP schools, they are making a sacrifice for their family. While each of these traits helps student achievement, the high attrition rate may speak to the fact the demands of time on a low-income family are too much for the family unit to bare.

This idea has also been supported by Gamoran (2000), who found that the school a child attends could have more of an impact on their coursework and post-secondary plans then the actual courses they are placed in or elect to take. This is also illustrated in *The Condition of Education* special report on high poverty schools (Aud, et al., 2010). That is, regardless of the course offerings at such schools, the achievement gap between high poverty and low poverty schools is wide and not showing any signs of closing, based on longitudinal data. It may also be reasonable to infer that parents who are selecting their child's public school are selecting out of their assigned school and into another school because they perceive that there will be some benefit in attending this school to their child. The data analyzed for this study may indicate that parent's instincts about schools seem to serve their children.

The idea of school choice has also taken on new meaning with the implementation of the No Child Left Behind Act. This is the first longitudinal study conducted by the National Center of Education Statistics since No Child Left Behind has

been in effect long enough for schools to offer school choice as part of No Child Left Behind sanctions. The fact that this option exists for children in Title I schools could be part of the reason the school choice response on the parent questionnaire yielded results that show an effect on mathematics course placement. Because of the nature of the sanctions of No Child Left Behind (in particular that they only affect Title I schools), it is reasonable to assume that parents taking advantage of this option could be opting to send their students from a demographically undesirable school to a more desirable school within the district. No Child Left Behind, in fact, only allows transfers to schools that have met their Annual Yearly Progress obligations.

The data from this study also suggest that whether parents selected their child's school really does not impact the level of mathematics course enrollment for students from the highest socio-economic status background. This could be due to the widely documented way that parents with more social capital are able to expertly navigate the school in order to make it work to the advantage of their children (for example, Epstein & Dauber, 1997; Gamoran, 2000; Lareau, 2004; Lareau & Cox, 2011; Tyson, 2011).

Mathematics Ability by Gender

The remainder of the two-factor ANOVA tests did not yield significant results, however the some of the data showed interesting trends. Mean values for course enrollment that considered the parent's perception of how females and males compare in their mathematics ability showed an interesting pattern. The graph of the means show that when parents perceive that males or females have more natural ability in mathematics, compared to the other gender, the mean course enrollments are higher than when parents believe males and females have equal natural ability in mathematics.

Table 7. Descriptive Statistics for Parent Beliefs About Mathematics Ability by Gender

SES Quintiles	Mathematics Ability by Gender	Mean	Std. Deviation
1	1	1.77	.931
	2	1.64	.950
	3	1.73	.927
	Total	1.70	.938
2	1	1.93	.831
	2	1.88	.880
	3	1.94	.860
	Total	1.91	.862
3	1	1.94	.895
	2	1.96	.865
	3	2.04	.878
	Total	1.98	.878
4	1	2.07	.854
	2	2.02	.899
	3	2.16	.844
	Total	2.08	.871
5	1	2.36	.827
	2	2.29	.861
	3	2.37	.847
	Total	2.34	.844

Note: Measure of Beliefs About Mathematics Ability and Gender described in Chapter III.

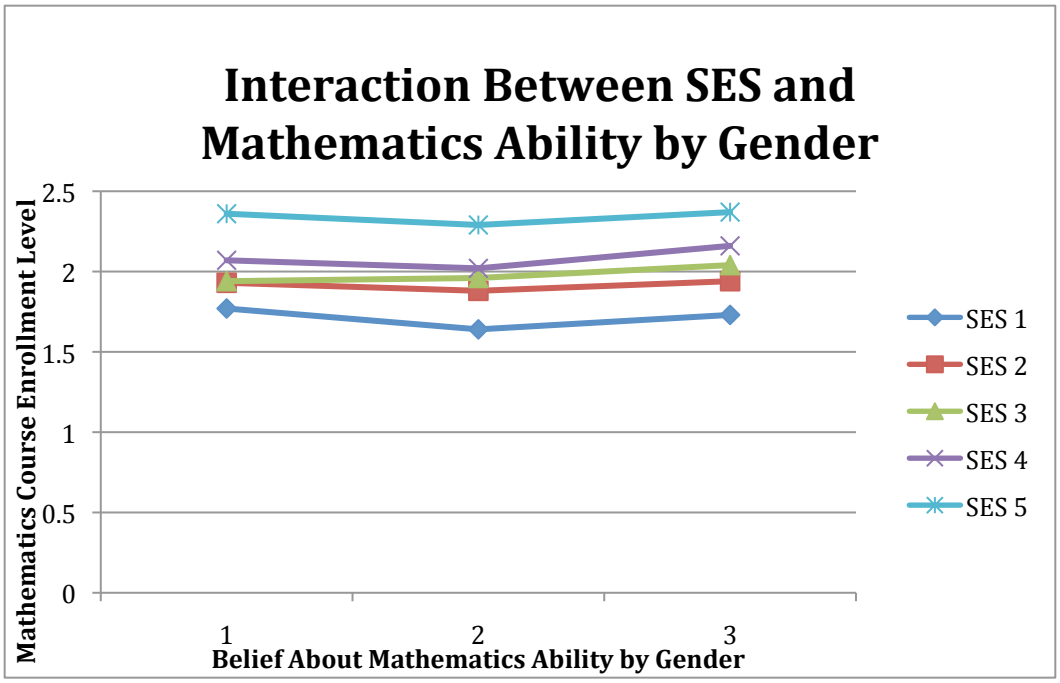

Figure 7. Parent Belief in Mathematics Achievement by Gender

The descriptive statistics and the interaction graph shows that in all cases when parents believed that males were to some degree better than females in terms of natural mathematics ability, course enrollment for their children were higher. This was true regardless of socio-economic status background. Kelly (2007), Chazen (2000), and Hammouri (2004) specifically address the idea of parent beliefs and the way they relate to course-taking decisions of high school students. Parent's beliefs about the importance of mathematics and their own ability in mathematics has shown that students who think mathematics is more important usually have friends, and in particular, mothers who think mathematics attainment is important. The belief that one gender has more natural ability in mathematics, might result in parents encouraging their children to enroll in mathematics because they believe they will have success in this area or it may lead to

parents encouraging their child to enroll in mathematics coursework because they do not want them to lag behind their classmates of the opposite gender in mathematics. Although I am unable to tell how many of the parents responding in this fashion have male or female children, it is reasonable to assume that parents may have this belief about male/female mathematics attainment, but they may be using this belief in different ways with their children depending on their child's gender.

Parental Connoisseurship and Homework

The questions regarding parents and their child's homework did not show a distinguishable pattern, either in terms of social class or level of mathematics course enrollment. With regard to the frequency with which parents help their child with mathematics homework, parents who helped their students more frequently with homework tended to be enrolled in lower mathematics classes on average.

Table 8. Descriptive Statistics for Homework Help from Parents

SES Quintiles	Frequency of Hmwk Help	Mean	Std. Deviation
1	1	1.77	.960
	2	1.68	.923
	3	1.55	.880
	Total	1.70	.938
2	1	2.00	.873
	2	1.87	.824
	3	1.71	.865
	Total	1.91	.862
3	1	2.03	.871
	2	1.94	.860
	3	1.89	.934
	Total	1.98	.878
4	1	2.15	.887
	2	1.99	.848
	3	2.01	.845
	Total	2.08	.871
5	1	2.38	.864
	2	2.29	.817
	3	2.27	.823
	Total	2.34	.844

Wang (2004) reports similar findings in her parent behavior study, relating parent behavior to mathematics performance on the 2003 TIMSS. This could be due to the fact that students enrolled in a higher-level mathematics course are talented in mathematics and do not seek help from their parents. This could also be due to the fact that parents are unable to help their students with mathematics homework when they are enrolled in upper level mathematics classes in high school.

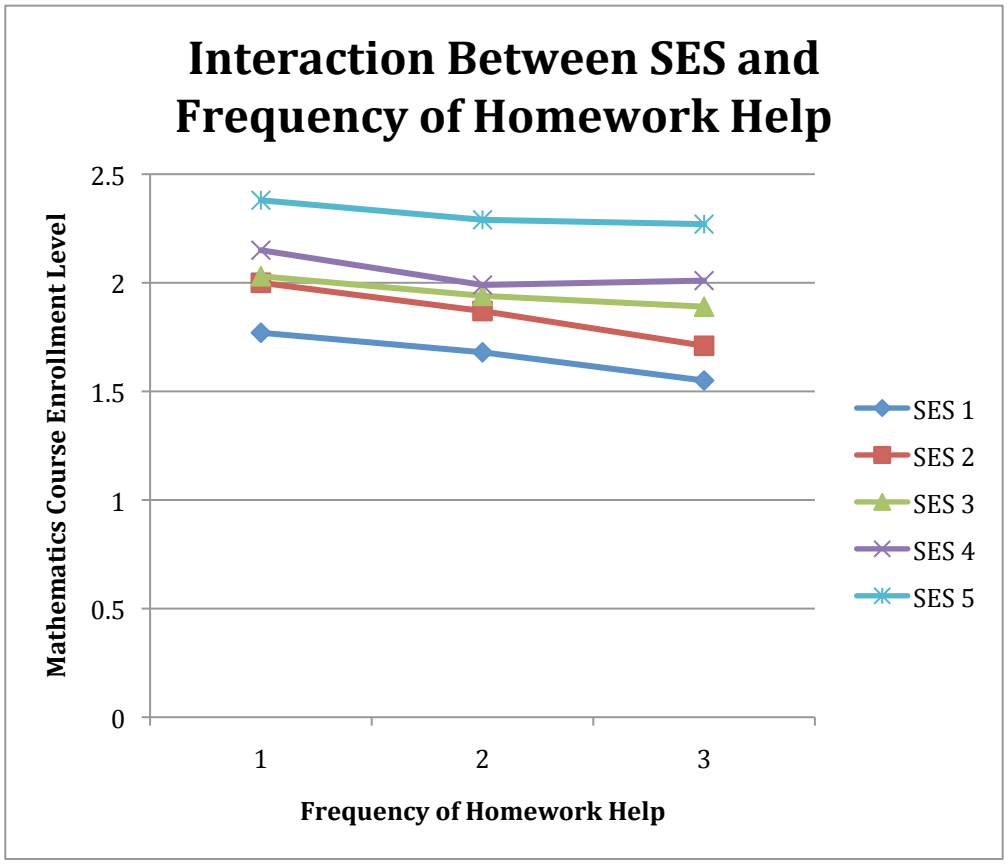

Figure 8. Frequency of Homework Help

Closely related to the idea of helping with homework is the notion of a parent's confidence level in their ability to help their 9th grade child with their mathematics homework. Parents who were not confident in their ability at all to help their child with mathematics homework did not have students who were enrolling in significantly lower level mathematics classes. Both the idea of helping a child with homework and feeling confident about helping a child with homework has been widely discussed in literature related to the sociology of education (for example, Baker & Stevenson, 1986). In particular the importance of the mother helping her children with homework has shown to have a large positive impact on both course enrollment and academic achievement.

Many of these studies were conducted with participants younger then 9th grade. It may be important for parents to be involved with homework procedures when children are younger to establish a pattern of support on behalf of the parents in the household. However, the findings from this study suggest that a parent's ability to help with mathematics homework during a student's 9th grade year may not play a big role in mathematics course taking decisions of students.

Table 9. Descriptive Statistics for Confidence in Homework Help

SES Quintiles	Confidence in Hmwk Help	Mean	Std. Deviation
1	1	1.70	.933
	2	1.69	.934
	3	1.75	.955
	Total	1.70	.938
2	1	1.86	.921
	2	1.92	.868
	3	1.91	.819
	Total	1.91	.862
3	1	1.98	.864
	2	1.97	.898
	3	2.01	.843
	Total	1.98	.878
4	1	1.93	.912
	2	2.09	.890
	3	2.09	.826
	Total	2.08	.871
5	1	2.15	.961
	2	2.36	.833
	3	2.32	.839
	Total	2.34	.844

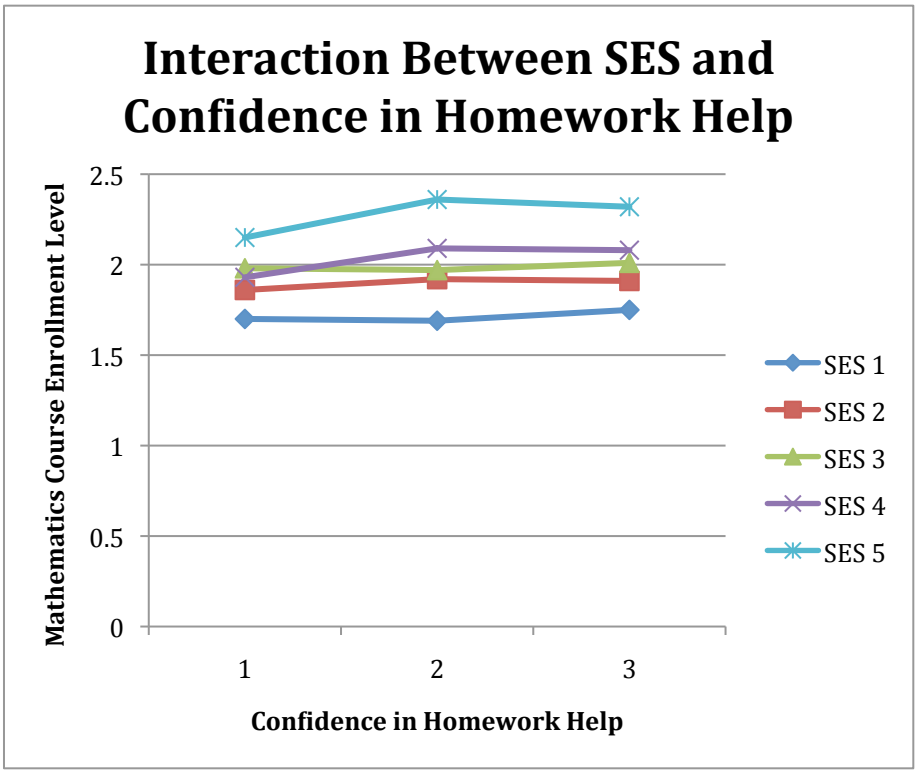

Figure 9. Confidence in Ability to Help with Homework

Direct Parental Connoisseurship

The frequency with which parents engage in direct parental connoisseurship seemed to affect levels of mathematics course taking among 9th grade students in the same way, regardless of social status.

Table 10. Descriptive Statistics for Direct Parental Connoisseurship

SES Quintiles	Direct PC	Mean	Std. Deviation
1	1	1.71	.959
	2	1.69	.937
	3	1.72	.910
	Total	1.70	.938
2	1	1.82	.855
	2	1.92	.854
	3	1.97	.879
	Total	1.91	.862
3	1	2.01	.840
	2	1.96	.887
	3	2.00	.884
	Total	1.98	.878
4	1	2.00	.833
	2	2.07	.884
	3	2.12	.863
	Total	2.08	.871
5	1	2.24	.824
	2	2.35	.816
	3	2.33	.878
	Total	2.34	.844

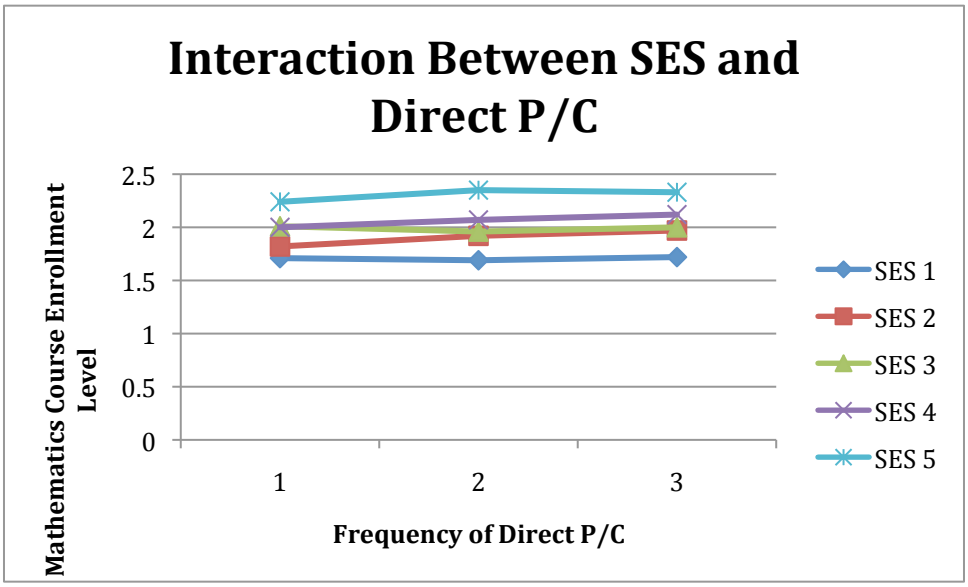

Figure 10. Direct Parental Connoisseurship

That is, the amount of direct parental connoisseurship behaviors exhibited by parents, seemed to have little, if any, impact on mathematics course enrollment patterns. This could be due to the fact the many forms of direct parental connoisseurship are compelled by the school. That is, schools often encourage all parents to come to parent teacher conferences, or organize scheduling planning nights for all students. The documented problem with parents from low income backgrounds participating in these forms of direct parental connoisseurship is that coming in to the school building to participate in parent-teacher conferences, or meetings with the school counselor about course enrollment decisions, have been shown to be conducted by school officials in different ways with parents from different backgrounds (Caro, Lenkeit, Lehmann, & Schwippert, 2009; Hill, Castellino, Lansford, Nowlin, Dodge, Bates, & Pettit, 2004). School officials are less likely to outline all course taking options and implications for parents from lower

economic backgrounds, and parents from these backgrounds are also less likely to speak up with questions or problems about their child's schooling experience (Lareau, 2004). Even though schools might be compelling parents to walk through the school house doors, the quality of the school/parent/student interactions once there do not serve parents and children from the varying social classes equally (Kelly, 2004; McFarland & Rodan, 2009).

Indirect Parental Connoisseurship

The data collected about varying levels of involvement with regard to indirect parental connoisseurship also shows similar trends across social class.

Table 11. Descriptive Statistics for Indirect Parental Connoisseurship

SES Quintiles	Indirect PC	Mean	Std. Deviation
1	1	1.68	.945
	2	1.74	.924
	3	1.61	.970
	Total	1.70	.938
2	1	1.84	.866
	2	1.97	.854
	3	2.09	.830
	Total	1.91	.862
3	1	1.99	.859
	2	1.96	.894
	3	2.12	.827
	Total	1.98	.878
4	1	1.97	.896
	2	2.12	.857
	3	2.19	.836
	Total	2.08	.871
5	1	2.25	.874
	2	2.34	.840
	3	2.49	.778
	Total	2.34	.844

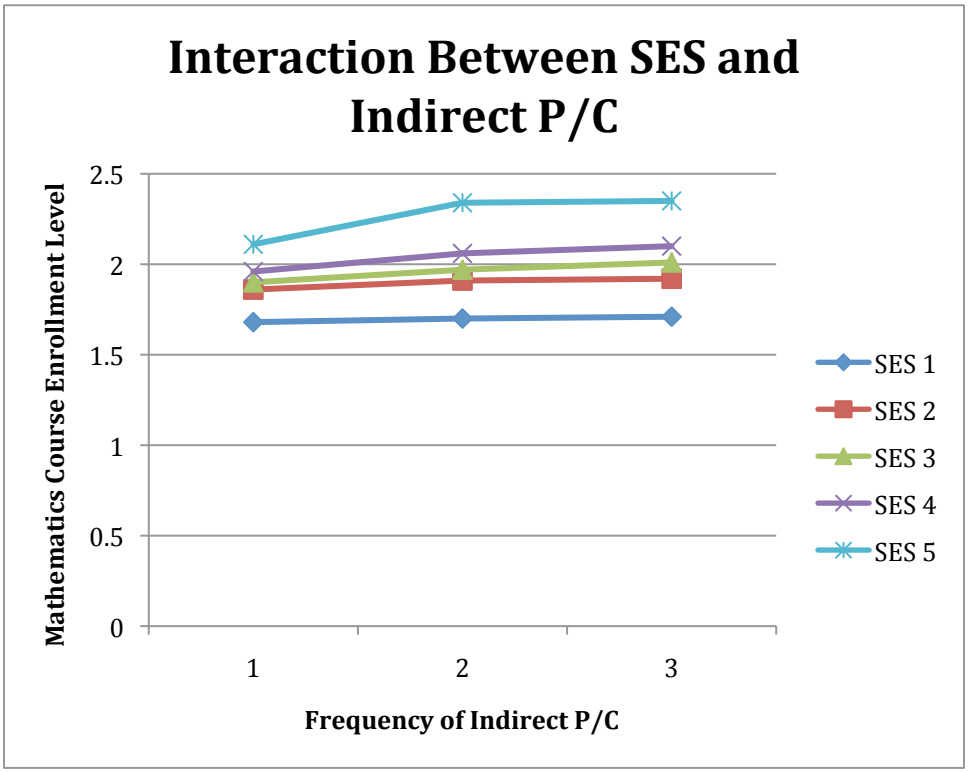

Figure 11. Indirect Parental Connoisseurship

From looking at the graph of mean course enrollments, it appears that as the frequency of direct parental connoisseurship increases, so does the level of mathematics course enrollment. It also appears that students from the highest quintile of socio-economic status experience the largest increase in enrollment as the frequency of these activities increases from 0 – 1 activities to 2 – 4 activities. It is also noteworthy that regardless of the frequency of this type of indirect parental connoisseurship, mathematics course enrollment for the lowest quintile of students remains basically unchanged. This type of indirect parental connoisseurship is different from the passive indirect parental

connoisseurship discussed at the beginning of the chapter. These types of activities are activities that parents responding on the questionnaire reported doing with their children. They included: trips to the zoo, visiting a library, working or playing on a computer together, building or fixing something together, attending a school science fair, working on a science fair project together, discussing a program or article about mathematics or science, and going to a live show together. Just as most parents are unsure about how to make the discussions with school personnel work to the advantage of their students, it is likely that parents from lower income backgrounds are unsure especially about how to make these experiences work to the advantage of their students. Coleman (1987), Borman and Dowling (2010), and Willms (2003) assert that social capital is acquired from people and experiences surrounding the parent and child. When parents and children are isolated from this type of social interaction, simply engaging in these activities, without using them to acquire more social capital, may not be as effective as engaging them with the idea of concerted cultivation (Lareau, 2002).

Main Effects

As expected the main effects of socio-economic status are significant. That is, there is a significant difference in level of mathematics course enrollment according to the socio-economic status quintiles used in this study. The average course enrollment level for a student from the lowest quintile was 1.70 (Recall, that according to Bozick and Ingles (2008), the standard level of enrollment which is needed for college admittance and high school graduation in most states, is 2), while the average course enrollment level for a student from the highest quintile was 2.34. Additionally, only the two highest quintiles for socio-economic status had an average course level enrollment of at least 2.

This is similar to findings from Bozick and Ingels (2008), which found that the most common pattern of mathematics course taking in high school is Algebra II in 11th grade and no mathematics in 12th grade.

Table 12. Descriptive Statistics for Level of Course Enrollment by SES

SES Quintiles	Mean	Std. Deviation
1	1.70	.938
2	1.91	.862
3	1.98	.878
4	2.08	.871
5	2.34	.844

By looking at the descriptive statistics for level of mathematics course enrollment, we find that the mean level of course enrollment increases, but the standard deviation for level of mathematics course enrollment decreases. That is, not only are children from higher socio-economic backgrounds enrolling, on average, in a high level of mathematics coursework they are also doing so with less variability. This means that students from the highest socio-economic status quintile are enrolled in high-level mathematics classes, on average, and that there are fewer students in a substantially lower course placement track. Erikson and Goldthorp (2002) found that in order for teenage children to achieve significant social mobility, in terms of moving up a social class, the children from low socio-economic backgrounds must attain almost two times as much education as their middle and upper class counterparts. The exposure to curriculum that children experience in middle and high school, and as shown in the data collected for this study, might help to explain this phenomenon. That is, parents from low income backgrounds

understand that education may be used as a tool for upward social mobility, but they are unaware of the amount or quality of education that must be obtained to achieve it.

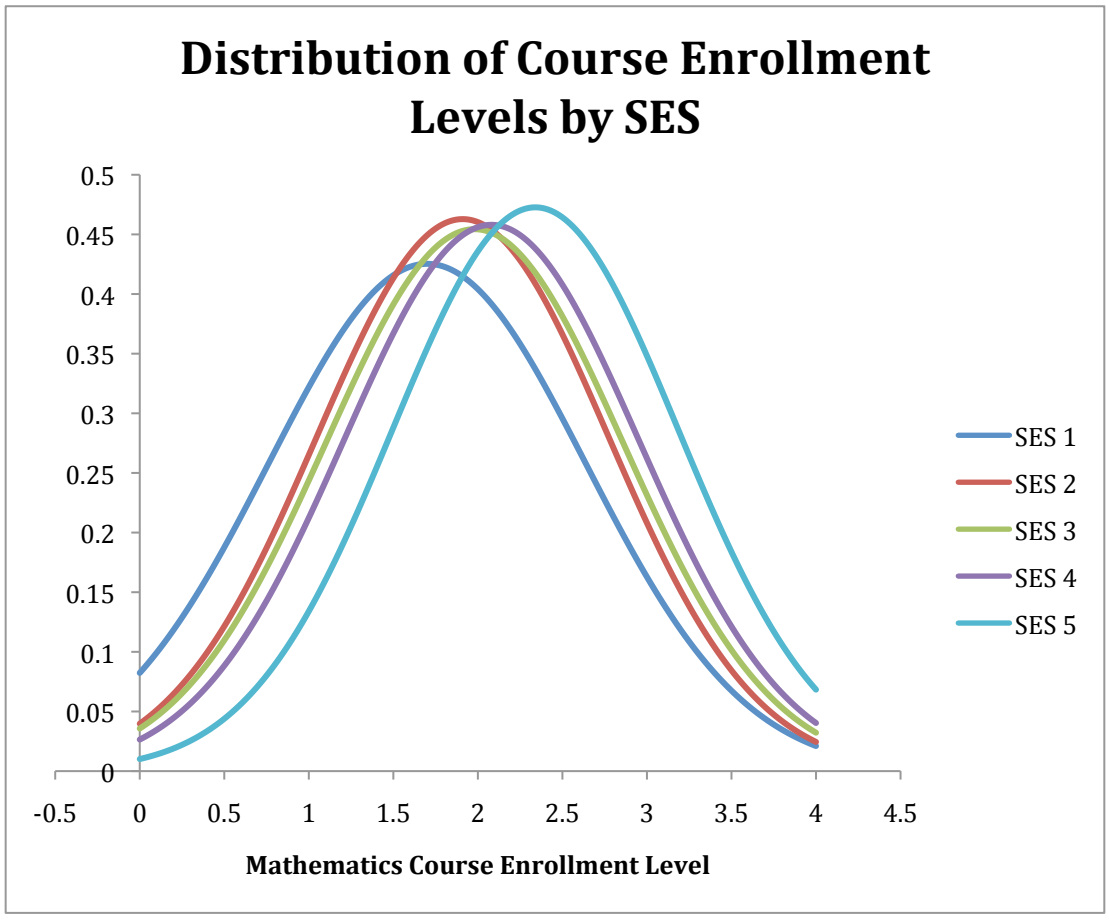

Figure 12. Distribution of Level of Mathematics Course Enrollment by Socio-economic Status

In many cases the main effects of parent behaviors were also significant (see Appendix A). In particular the frequency with which parents engaged in passive indirect parental connoisseurship and indirect parental connoisseurship positively influenced their child's course enrollment, as did parent's beliefs of sex differences in natural mathematics ability and whether or not parents selected their child's school. The

frequency with which parents helped their children with mathematics homework, however, had a significant negative impact on level of mathematics course enrollment. The parent behaviors of direct parental connoisseurship and confidence in the parent's ability to help with mathematics homework were shown not to be significant at the .05 level.

Frequency of Parent Behaviors

The second question I address in this study is whether parents from middle and upper socio-economic status backgrounds engage in parental connoisseurship more frequently. Previous research indicates that parents from middle and upper socio-economic status backgrounds engage in parental connoisseurship more frequently then those in lower socio-economic settings (Crosnoe & Mistry, 2010; Gamoran, 2002; Kelly, 2004; Oakes, 2005; Tyson, 2011). The data collected from this study are mostly in line with previous findings. To address this question of parent connoisseurship frequency, I grouped parents from the lowest and middle low quintile and the parents from the middle, middle high, and highest quintile. Then, I compared proportions of the frequency with which parents indicated they participated in at least two activities from each category of parental connoisseurship.

Table 13. Frequency of Parent Behaviors by SES

Parent Behavior	SES Quintiles 1 and 2	SES Quintiles 3, 4, and 5
School Choice	42%	44%
Direct PC	76%	88%
Homework Often	49%	38%
Passive Indirect PC	47%	70%
Indirect PC	88%	96%

The frequency with which parents from various socio-economic backgrounds selected their child's school, does not seem to vary much, based on socio-economic status. The descriptive statistics indicated that students from the lowest quintile enroll in a higher level of mathematics coursework when their parents have selected their school. The benefits for children from upper level socio-economic backgrounds were negligible. Children from low socio-economic backgrounds whose parents select their public school are presumably deciding not to send their child to the neighborhood public school (otherwise they would have indicated this choice on the parent survey). Often the neighborhoods children live in reflect their own socio-economic status. If parents from low-income backgrounds are selecting a different school for their children to attend, it is reasonable to assume that they are probably sending their child to a school with a different demographic from the one their child would be attending by default. This decision on behalf of the parents likely moved their child from a school with a higher amount of poverty to a lower poverty school. Although the course enrollment means indicate that there may be more advantage to students from lower socio-economic backgrounds, parents tend to select their child's school at about the same amount of frequency.

Although involvement in direct parental connoisseurship did not show a significant difference in level of mathematics course enrollment, parents from middle and upper level socio-economic status backgrounds tend to participate in direct parental connoisseurship more frequently. This could happen for a variety of reasons. First, parents from middle and upper class backgrounds have been shown to feel more comfortable in their child's school, interacting with their teachers, and making requests to

the school on behalf of their child (Crosnoe & Schneider, 2010; Lareau, 2002; Lareau & Cox, 2011). Parents from upper and middle income families are also more likely to have friendships with school personnel in other social settings, making entering the school to participate in their child's schooling directly less intimidating.

Second, parents from middle and upper class backgrounds tend to have more time in their schedules to participate in school activities, or they have the flexibility in their schedules to make the time for these activities. Many times families from middle and upper class backgrounds have jobs in which their working hours are negotiable. It is reasonable to expect that a parent with a professional job would be able to arrange their schedule to come help at their child's school or to arrange special meetings with their child's teacher. Additionally, families from middle an upper class backgrounds are more likely to be part of a two-parent home, making it easier for parents to free themselves up for time to spend in the school, either as a volunteer or to take part in the school's parent and teacher organization, or to come to meet with teachers and other school personnel.

Parents from lower income backgrounds indicated that they help their child more with mathematics homework, compared to parents from middle and upper class backgrounds. The data also indicate that students from lower income backgrounds tend to be enrolled in lower level mathematics courses when compared to their middle and upper class counterparts. The fact that the mathematics these students are enrolling in may be a lower level makes the mathematics material more accessible to these parents. Parents may also be more inclined to help their child with homework, if they have a previous history of struggling with lower academic achievement in mathematics. This finding is not in line with much of the documented research relating parent involvement

with homework and socio-economic status. However, as noted previously, many of these studies dealt with parents helping younger children with homework, instead of high school aged children.

Parents from middle and upper class backgrounds participate in both passive and active indirect parental connoisseurship more frequently. This might be due in large part to the fact that these families tend to have the resources of both time and money in greater abundance. Many of the activities listed in the passive and active indirect parental connoisseurship categories involve cost to the family of some sort. When there is not a monetary cost to be incurred by the family, there is most certainly the cost of the family's time. Each of the activities listed in these two types of indirect parental connoisseurship involve the cost of time on behalf of the family, whether it involves dropping a child off and picking them up, or say taking them to zoo, or playing on a computer together at home. Many families from lower socio-economic status backgrounds do not have the luxury of time that middle and upper income families have.

Profile of Parents Engaging in Parental Connoisseurship

Although the specific activities parents engage in were not listed for the two-factor ANOVA I conducted as part of this study, I used descriptive statistics to try to identify the types of activities that might be the most beneficial for parents to participate in with their child, regardless of socio-economic status. In other words, what are the specific behaviors (instead of the frequency of the types of behaviors) that result in a higher average mathematics course enrollment in freshman year mathematics class?

To analyze these data, I considered what the average level of mathematics course taking was for students/parents participating in the activities from the parent

questionnaire (See Appendix B). For most of the factors listed in the parent questionnaire, parent or student participation resulted in a higher average mathematics course level enrollment. However, when parents attended a meeting at school with the counselor or parent teacher conferences, fixed something at home with their child, and helped them work on a science project; the average course enrollment for these students were lower, compared to students whose parents did not engage in these activities.

Participation in these four activities could be indicators of a problem at school, or could be an indication of the family's socio-economic status. For example, parents who have attended a meeting with their child's counselor at school may have done so because of a problem with student behavior or grades. Additionally, the school may only select a certain population of students that the counselors need to meet with during their freshman year of high school. If this identified group of families happen to be families of at risk students, it would be reasonable to expect that the mean level course enrollment for this parent behavior would be lower than students whose parents had not met with the school counselor. Similarly, it is reasonable that parents whose children are experiencing problems in school, or who have a history of problems in school might be more likely to be asked to come or would elect to come to parent teacher conferences.

Additionally, children who have worked to fix something with their parent may have the opportunity to work on fixing a household item because their parent has specific ability in that area, which might be an indication of their employment, or because the family does not have the money to pay for the item to be fixed. This particular item may be an illustration of the dependency the family might have on one another to keep the household functioning, as described by Lareau (2004).

Finally, parents working with their children to complete a science project could be an indication of the same phenomenon at work with parents who help their 9th grade children with homework. It might be that if parents are helping their child complete a science project, it is because they struggle in that particular area or are struggling generally in school. This might also lead to a lower average course enrollment level in mathematics.

Parent activities that yielded the largest difference in average course enrollment were parents who enrolled their child in mathematics or science camp, enrolled their child in another kind of camp, attended a school event, and took their child to a live show or play. It is interesting to note that three out of the four of these activities are likely to both cost the family quite a bit of time and money.

Parents who enroll their child in a mathematics or science camp presumably have a 9th grade student who is interested in mathematics or science. Many times students are either asked to apply to a mathematics and science camp or given information about mathematics and science camps by their teachers. According to Crosnoe and Schneider (2010), these types of conversations are much less likely to occur between teachers and students when the students are from lower socio-economic backgrounds. Even when students do not have to be asked to participate in a mathematics or science camp many of these programs cost money and require the child to be away from home for the duration of the camp experience. This is also something that is much less likely to occur when students are from lower socio-economic status backgrounds.

Although attending another camp, such as a summer recreational camp, may not have the academic restrictions that mathematics and science camps have, the issue of

time and money is still an obstacle. Because of these considerations, it could be that measuring the mean enrollment level of mathematics for these students is simply a proxy variable for socio-economic status of the student, regardless of academic ability.

Similarly, parents who have taken their child to a live show in the past year are also exhibiting some form of social capital. That is even when the live show or concert is free, parents must have enough social awareness to both seek out these experiences and orchestrate the outing to see a live show or concert. This is seemingly another way to measure a parent's level of social capital, in comparison to other parents. Even if parents are not from a particularly wealthy background, the social capital parents display by taking their students to a live show or concert is considerable.

Finally, parents who attend a school event, outside of parent-teacher conferences, also result in a high mean level of mathematics course enrollment. This could be due to the fact that parents who are coming to these events are not necessarily being compelled to enter the school because of academic concerns or a problem at school. Parents coming to school for another school program are coming to school to support their child in an endeavor outside of that of the classroom. This is another measure of a parent's social awareness of the importance of being involved in the life of their child's school experience.

CHAPTER V: CONCLUSIONS AND RECOMMENDATIONS

> Our problem is that everybody tries to heal each of the individual aspects of poverty, not poverty itself.
>
> Bob Geldof

Recommendations

This study sought to identify ways parents interact with their child and their child's school that might lead to a higher level of mathematics course enrollment during their freshman year of high school. Although the findings of this study are mixed, various implications for schools and parents can be considered.

In 1988, Bidwell and Friedkin identified three reasons that children from middle and upper class families experience greater success and a better overall K – 12 schooling experience. They identified the education of the families, the quality of learning resources provided by the family, and favoritism of middle and upper class families in the learning environment as integral players in explaining the achievement gap between students from disadvantaged and middle and upper class backgrounds. Almost 25 years later, the findings of this study support the three reasons laid out by Bidwell and Friedkin (1988).

In most cases when parents engaged with their child in spontaneous educational experiences outside of the school day (what I call indirect parental connoisseurship), their child tended to enroll in a higher-level mathematics course during their freshman year in high school. This may indicate that the learning students do outside of school is as meaningful as their classroom experiences in terms of sparking their interests and encouraging them to seek higher levels of education. Bransford, Brown, and Cocking

(2002) uses this graphic to illustrate the importance of a child's out of school activities as it relates to learning:

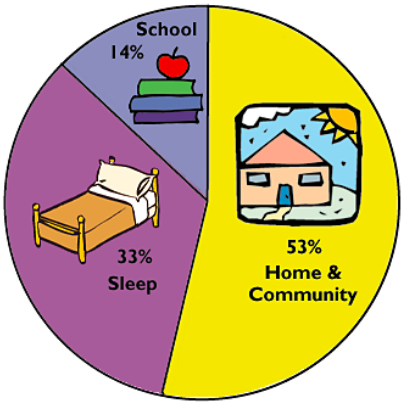

Figure 13. Division of a Child's Time.

Source: Brandsford, J.D., A.L. Brown, & R.R. Cocking (Eds). (2002). *How people learn: brain, mind, experience, and school.* Committee on Developments in the Science of Learning and Committee on Learning Research and Educational Practice, Commission on Behavioral and Social Sciences and Education, National Research Council.— Expanded ed. Washington D.C.

Caro, McDonald, Planck, and Willms (2009) studied the out of school experiences of students and the way they relate to achievement in the classroom. The findings from this study indicated that when students from low socio-economic status backgrounds participate in out of school activities, in which they are interacting with other adults and children, they seem to reap the rewards of their upper and middle-income counterparts. That is, students are able to acquire a certain amount of social capital through their experiences with children and adults from various backgrounds. The graphic provided by Bransford, Brown, and Cocking (2002) shows that what

happens outside the classroom, through interactions with school and community, most certainly plays a bigger role in the lives of children then what teachers and other school personnel can do within the confines of the school day. This study also indicates that it is not only the fact that children are participating in these activities that is important. It is also the frequency and the types of such activities that have an impact on the outcome in terms of mathematics course enrollment.

Combining the work of Entwisle, Alexander, and Olson, (1997, 2001) with the findings from this study may suggest that social agencies and private organizations which are focused on providing low income students with some of these out of school experiences similar to that of their middle and upper class counterparts may find greater academic benefits, in terms of course enrollment, when children are given opportunities to participate in these activities with students from various socio-economic backgrounds. This is in contrast to many programs that currently exist with provide low socio-economic students with similar activities that are offered to socially homogenous groups of students. Additionally, children and families may be able to participate more regularly in these types of activities when social supports are in place to allow children to participate in these activities without loss of contributing to the day-to-day family operations.

This also speaks to the implications of school choice and the hyper segregation (Kozol, 1995) of poor students that results. Ravitch (2010) speaks to the power school choice programs have in re-segregating schools, both in terms of race and socio-economic status. Previous research (Coleman, 1987; Gamoran, 2000) find that partitioning school experiences according to social class hurts students from low socio-

economic backgrounds, in terms of academic achievement, and does not have a large impact on students from high socio-economic backgrounds either way. Given the fact that this study finds that children from the lowest socio-economic status quintile enroll in a higher level mathematics course during their freshman year when parents select the public school they attend, this study seems to indicate that heterogeneity among students in schools could benefit lower income students in terms of course enrollment.

The data from this study also illustrate that forms of direct parental connoisseurship that are beneficial for middle and upper income parents are not necessarily beneficial to parents from low socio-economic status backgrounds. Lareau (2004) finds that both teachers of low-income students and parents of these same students are frustrated by they way these groups of adults work with each other. It seems that middle and upper class parents make forms of direct parental connoisseurship work for them by interacting with their peers in the workplace, through casual conversations with school personnel outside of the school day, or by following the example of their parents. Adults who have not had exposure about how to use parental connoisseurship to their advantage could benefit from being taught how to work with the school, in terms of benefits for their children.

Schools do not usually teach parents how to advocate for their children in terms of insisting on better course placements or making exceptions for placement in special programs, because this is not the type of parental involvement schools desire. However, asking parents to come to parent teacher conferences or to come meet with a school counselor seems to not have any impact on level of mathematics course enrollment for poor children. In order for forms of direct parental connoisseurship to be meaningful for

these children, parents must be taught how to navigate the policies of the school, including ways of appealing and disagreeing with school official's decisions. This behavior most likely represents a cultural change on behalf of parents from low-income families in the way they interact with the school.

Overall, this study finds that simply going through the motions of parent behaviors that might be considered desirable do not have much effect on student's mathematics course level enrollment. Parents must be taught how to select meaningful out of school learning experiences for their children. They must also be taught how to interact with their children when they take them to the zoo or to a museum. A parent going through the motions of parenting activities, without knowing how to really navigate the landscape of teaching their child through experience will experience the sacrifice of time and money, without seeing the academic benefits. Similarly, parents who participate in forms of direct parental connoisseurship without understanding how to interact with agency of the school will not reap the same rewards as their middle and upper class counterparts.

Because it is unlikely that schools will educate parents in how to manipulate the system to work to their advantage, other private or socially agencies may be able to fill the gap in teaching parents how to deal with the school in order to make the school work to the best advantage of their child. It is the parent's responsibility to advocate for the best education for their child. It is the school's responsibility to make decisions based on the overall betterment of the child in balance with the overall function and purpose of the school. When these two motivations do not yield the same result, parents must be able to advocate for the best academic outcome for their child.

Areas for Further Research

I used data collected by the National Center of Education Statistics that is the first set of collected data in this longitudinal study. An obvious follow up study to this one would be to obtain the data for these same students during their senior year to see which students stayed on their mathematics trajectory, which ones jumped off early, and which ones excelled past their forecasted mathematics placement. Parent behaviors related to these variations from the mathematics pipeline, particularly those behaviors that encouraged students to persist in mathematics longer than expected would be of particular interest.

Another area for further study would be to consider the achievement scores in mathematics for the students in this data set, instead of the level of mathematics course enrollment. As part of this longitudinal study students who completed the survey also took a computerized algebra exam. The link between course enrollment and algebra scores or algebra scores and parent behaviors would also be an area for further study. Additionally, the National Center of Education Statistics collected data from each student's teacher, counselor, and school principal. Considering all other aspects of the data provided in this data set might give a more complete picture of each student for this study, as well as the ancillary information about the child's school.

Qualitative data related to this study would also help to give a more complete picture of the way the parent, school, and child are intertwined to result in upper or lower level course enrollment. In particular, outliers from both low and high income students in relationship to their mathematics course enrollment might further highlight the important parent behaviors related to mathematics course selection. When students from low socio-

economic status backgrounds persist in upper level mathematics course taking, what were their specific experiences in the classroom and in their interactions with their parents that lead them to make this decision to take an upper level mathematics course, or to stay in the mathematics pipeline longer? Although size of school was not collected as part of this data set, the setting of the school (urban, suburban, rural) was. The relationship between school setting and course enrollment of lower income students would also be of particular interest.

Although I decided to omit Catholic and private schools because of documented Catholic School Effect, a similar study with regard to the Catholic and private schools would be interesting. Ravitch (2010) asserts that Catholic and private schools, which used to be immune to the problems of public schools, are also experiencing difficulty in dealing with extreme poverty within their schools. Do these collected data support the fact that after the establishment of school choice and the use of vouchers the Catholic School Effect is still as powerful?

Because the parent factors of active and passive indirect parental connoisseurship, school choice, and helping students with homework showed to be significant in the study, follow up studies related to the particular types of parent behaviors within each of these categories warrants further exploration. Parent beliefs about mathematics achievement with regard to gender was also found to be significant and the results of the analysis of means were particularly interesting. Further research on parent beliefs and mathematics course enrollment would be a noteworthy follow up to this study.

This data set also represents one of the largest data sets collected with students who, for most of their school careers, have been part of the public school system while

No Child Left Behind has been in effect. Although there were not specific questions related to No Child Left Behind factors such as school choice and mathematics proficiency have taken on a new meaning in the context of these survey questions. Implications on the attitudes of mathematics and science since the implementation of No Child Left Behind would be accessible from this data set.

Finally, I focused on the school experience of the child once they enter high school. It is unlikely that this is the first time these students have been sorted according to their perceived ability in mathematics. It would be interesting to consider the school and family experiences of the child in elementary and middle school that may have lead to their ninth grade course placement in mathematics.

Conclusion

Is demography destiny? Just as mathematics course taking has been described as" traveling along a trajectory" or "entering a pipeline", can a student's school experience be determined by their demographics before they even enter the schoolhouse doors? If one looks at the central tendencies, the answer to both of these questions seems to be yes. The problem of poverty is considerable and not even a social agency as large as public schools can equalize effects. Schools do yield meaningful individual success stories. The problem is that there just have not been enough of them.

This study only considered one small part of a child's K – 12 schooling experience – that is their freshman level mathematics course taking patterns and the predicted trajectory of the rest of their secondary mathematics experience. However, past research has shown that mathematics course taking is also related to college attendance and degree attainment and other indicators of post-secondary success such as

employment status after both college and high school (Adelman, 2006; Sadler & Tai, 2007). Because mathematics course taking can be an indicator of so many other academic and social behaviors, not related to mathematics, measuring the level of mathematics course enrollment may indicate other important academic behaviors in high school and beyond.

The findings from this study indicate that the way parents interact with the school and other organizations on behalf of their child have an impact on the course enrollment level of their child. This study also finds that these parent behaviors affect children from differing socio-economic status backgrounds in various ways. In part, I found that there is not one single parent behavior that benefits all children at all times, in terms of level of mathematics course enrollment. However, regardless of socio-economic status there are particular behaviors that may benefit children's course taking enrollment levels in mathematics.

One of the main outcomes of this study, which has been confirmed in other bodies of research, is that the school works best for children when parents are adept at making it work for them. For parents from lower socio-economic backgrounds, this may mean that when parents have the social savvy to select their child's school, they are giving them the largest benefit in terms of level of mathematics course enrollment. For low income families, selecting the school their child attends is no small task. As outlined by Petrilli (2007) and Ratvitch (2010), low income families that decide to send their child to a school different from their assigned neighborhood school must navigate paperwork, deadlines, and in some cases school applications in order to be able to take part in the

school choice option. This study shows that when parents participate in the school choice option, their children experience a pay off in terms of course enrollment.

Additionally, the sacrifices these families make in order for their students to attend a school of the parent's choice does not stop once the child has been selected to attend the school. The commitment of longer hours traveling to and from school and the realities of making new friends outside of the neighborhood are also part of this school choice process. When a low-income child attends a choice school, it usually represents the exercise of social capital on behalf of their parents. In other words, school choice generally measures the dedication a low-income parent has to their child's schooling.

For the children from middle and upper income backgrounds, parents who engage in behaviors that relate to the idea of concerted cultivation (Lareau, 2004) tend to have a higher mean value of mathematics course enrollment. This also represents a type of social capital on behalf of the parents. Parents who have the time and financial resources to seek out extra curricular activities for their child see rewards in terms of mathematics course level enrollment. In contrast to parents from the lowest socio-economic quintile, parents from middle and upper income backgrounds saw a higher course level enrollment in mathematics when they engaged in a large number of passive indirect parental connoisseurship activities. Such parents usually have the social support to juggle busy schedules and to otherwise accommodate such activities.

Although particular parent behaviors were found to lift the mean mathematics course enrollment level for children according to their socio-economic status, there were not any parent behaviors engaged in by parents from the lowest quintile of socio-economic status that raised the mean level of course enrollment to equal any other

quintile's mean course enrollment level. For certain quintiles (especially the middle, middle high, and highest), course enrollment means were fairly consistent, sometimes one mean was slightly higher than the other, indicating that once parents attained a certain level of income and job status, it was likely a function of their local and global knowledge (Lareau & Cox, 2011) of schooling, and their ability to secure an improved school experience for their child. Although Tyson (2011) found that parents from lower income backgrounds understand the importance of schooling, her findings and the statistics from this study indicate that they are unable to "crack the code" of ensuring that their child has a meaningful and rigorous school experience.

The disparity in mathematics course enrollment and effectiveness of parent behaviors points to the larger problem of poverty as a whole. Although it is true that some parents are not involved in the school lives of their children, this is not a characteristic that is unique to families from low socio-economic backgrounds only. And while I acknowledge that there are teachers who may discriminate against children from disadvantaged backgrounds, there is no evidence that such beliefs pervade the intentions of professional educators. This study, along with numerous studies that came before this one, are detecting a "poverty problem" which is playing out as a "school problem." Poverty does present a problem in schools, but the misconception is that poverty is more of a problem with regards to schooling than it is in any other aspect of a child's life. The problem of deep, debilitating poverty in the United States is one that no government agency, on a large scale, has been able to effectively combat – the public school being among them. In a study of longitudinal data about Canadian youth, Willms (2003) summarizes his findings by saying,

> […] it is not possible to identify and focus on a single factor in [the Canadian] government's social policy. Rather there are several factors, both at family and community levels, which by themselves appear to have a small effect, but taken together, they can have a substantial effect on children's early development.
>
> (p.2).

The findings in this study support that same phenomenon. There is no single parent behavior that results in children enrolling in upper level mathematics course work. Rather, it an accumulation of many parent behaviors, as well as a child's interaction with the community around them, that lead to course selection in middle and high school.

In the book *The Death and Life of the American School System*, Ravitch (2010) outlines a variety of ways that individual charter schools or private schools or, in some cases, public schools have been able to deal with impoverished children. However she states that,

> Success, whether defined as high test scores or graduation rates or student satisfaction, cannot be bottled and dispensed at will.
>
> (p.137).

Similarly, she warns that copying a particular curriculum or leadership style or even to copy the layout of a school day from school to school cannot yield the same results. Schools are in the business of people, in particular children and parents and their surrounding communities. To find one parent behavior that leads to success for all students in the classroom is about as unlikely has finding one particular mathematics program (or leadership style, or class size, or style of teaching) that will result in all students achieving the same result in mathematics. However, the data in this study and in other studies are consistent in one aspect. When students from low socio-economic status backgrounds are able to interact with peers, teachers, parents, and other adults who have

high expectations for achievement, they, in most cases, rise to the challenge and benefit from the normative influences that follow from those interactions.

Like many people interested in education before me, I started on this endeavor to find a list of parent traits that would raise a child's level of mathematics course enrollment. I fell into the trap of a "one size fits all" mentality (its so easy to do when looking at numbers, instead of students). Luckily, in this case the statistics brought me back to the reality that I had experienced when teaching in my mathematics classroom. Children cannot be reduced to a measure of parent behaviors and an average course level enrollment score. There really is no magic bullet, no best practices that we can export. The lesson here is that parents can influence and agitate for a learning environment in their children's school. At the same time, they can engage in any number of out-of-school behaviors that will help set the pathway for school success. Among them is course selection.

APPENDIX A: STATISTICAL TABLES

Table A.1. Number of Parents Choosing Their Child's School

		N
SES Quintiles	1	2104
	2	2007
	3	1974
	4	2058
	5	2800
Parents Chose School	1	6179
	2	4764

Table A.2. Number of Parents Engaging in Frequencies of Direct Parental Connoisseurship

		N
SES Quintiles	1	2104
	2	2007
	3	1974
	4	2058
	5	2800
Direct PC	1	1808
	2	5736
	3	3399

Table A.3. Number of Parents Helping with Homework

		N
X1SESQ5	1	2104
	2	2007
	3	1974
	4	2058
	5	2800
P1HWOFTEN	1	5610
	2	3637
	3	1696

Table A.4. Number of Parents Confident with Their Ability to Help Their Child with Homework.

		N
X1SESQ5	1	2104
	2	2007
	3	1974
	4	2058
	5	2800
Confidence Level	1	1098
	2	6625
	3	3220

A.5. Number of Parents Engaging in Various Frequencies of Indirect Parental Connoisseurship

		N
SES Quintiles	1	2104
	2	2007
	3	1974
	4	2058
	5	2800
Passive Indirect PC	1	4216
	2	6104
	3	623

A.6. Frequency of Parents Engaging in Indirect Parental Connoisseurship

		N
SES Quintiles	1	2104
	2	2007
	3	1974
	4	2058
	5	2800
Passive Indirect PC	1	796
	2	4957
	3	5190

A.7. Descriptive Statistics for Parents Engaged in Indirect Parental Connoisseurship

SES Quintiles	Indirect PC	Mean	Std. Deviation	N
1	1	1.68	.963	325
	2	1.70	.938	1071
	3	1.71	.928	708
	Total	1.70	.938	2104
2	1	1.86	.826	169
	2	1.91	.852	996
	3	1.92	.880	842
	Total	1.91	.862	2007
3	1	1.90	.844	124
	2	1.97	.890	917
	3	2.01	.871	933
	Total	1.98	.878	1974
4	1	1.96	.867	94
	2	2.06	.867	906
	3	2.10	.874	1058
	Total	2.08	.871	2058
5	1	2.11	.905	84
	2	2.34	.827	1067
	3	2.35	.850	1649
	Total	2.34	.844	2800
Total	1	1.83	.908	796
	2	1.99	.902	4957
	3	2.08	.900	5190
	Total	2.02	.904	10943

Table A.8. Two-factor ANVOA for Direct Parental Connoisseurship

Source	Type I Sum of Squares	df	Mean Square	F	Sig.
Intercept	44781.757	1	44781.757	58248.292	.000
SES Quintiles	526.301	4	131.575	171.142	.000
Direct PC	4.182	2	2.091	2.720	.066
SES Quintiles by Direct PC	7.225	8	.903	1.175	.310
Error	8401.535	10928	.769		

Table A.9. Two-factor ANOVA for Homework Help

Source	Type I Sum of Squares	df	Mean Square	F	Sig.
SES Quintiles	526.301	4	131.575	172.195	.000
Hmwk Help	55.029	2	27.515	36.009	.000
SES Quintiles * Hmwk Help	7.746	8	.968	1.267	.256
Error	8350.167	10928	.764		

Table A.10. Two-factor ANOVA for Mathematics Ability by Gender

Source	Type I Sum of Squares	Df	Mean Square	F	Sig.
SES Quintiles	526.301	4	131.575	171.323	.000
Math Ability by Gender	14.299	2	7.150	9.309	.000
SES Quintiles * Math Ability by Gender	5.977	8	.747	.973	.455
Error	8392.665	10928	.768		

Table A.11. Two-factor ANOVA for Confidence in Homework Help

Source	Type I Sum of Squares	Df	Mean Square	F	Sig.
SES Quintiles	526.301	4	131.575	171.182	.000
Confidence in Hmwk Help	4.528	2	2.264	2.946	.053
SES Quintiles * Confidence in Hmwk Help	8.854	8	1.107	1.440	.174
Error	8399.559	10928	.769		

Table A.12. Two-factor ANOVA for Passive Indirect Parental Connoisseurship

Source	Type I Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	564.547[a]	14	40.325	52.619	.000
Intercept	44781.757	1	44781.757	58434.961	.000
SES Quintiles	526.301	4	131.575	171.690	.000
Indirect Passive PC	24.103	2	12.052	15.726	.000
SES Quintile * Indirect Passive PC	14.143	8	1.768	2.307	.018
Error	8374.696	10928	.766		

Table A.13. Two-factor ANOVA for Indirect Parental Connoisseurship

Source	Type I Sum of Squares	Df	Mean Square	F	Sig.
SES Quintiles	526.301	4	131.575	171.100	.000
Indirect PC	5.625	2	2.813	3.657	.026
SES Quintile * Indirect PC	3.709	8	.464	.603	.776
Error	8403.607	10928	.769		

Table A.14. Frequency of Course Level Enrollment by Participation in the Arts

		Arts		
		0	1	Total
Course Enrollment	0	849	389	1238
	1	756	280	1036
	2	3915	1943	5858
	3	2112	1634	3746
Total		7633	4246	11879

Table A.15. Frequency of Course Level Enrollment by Participation in Sports

		Sports		
		0	1	Total
Course Enrollment	0	665	573	1238
	1	555	481	1036
	2	2809	3049	5858
	3	1479	2267	3746
Total		5509	6370	11879

Table A.16. Frequency of Course Level Enrollment by Participation in a Religious Group

		Religious Group		
		0	1	Total
Course Enrollment	0	629	609	1238
	1	573	463	1036
	2	2836	3022	5858
	3	1760	1986	3746
Total		5799	6080	11879

Table A.17. Frequency of Course Level Enrollment by Participation in Another Club

		Another Club		
		0	1	Total
Course Enrollment	0	983	255	1238
	1	819	217	1036
	2	4615	1243	5858
	3	2810	936	3746
Total		9227	2652	11879

Table A.18. Frequency of Course Level Enrollment by Participation in An Academic Club

		Academic Club		
		0	1	Total
Course Enrollment	0	1053	185	1238
	1	856	180	1036
	2	4979	879	5858
	3	3123	623	3746
Total		10012	1867	11879

Table A.19. Frequency of Course Level Enrollment by Participation in a Mathematics or Science Camp

		Math or Science Camp		
		0	1	Total
Course Enrollment	0	1200	38	1238
	1	1015	21	1036
	2	5690	168	5858
	3	3527	219	3746
Total		11432	447	11879

Table A.20. Frequency of Course Level Enrollment by Participation in Another Camp

		Another Camp		
		0	1	Total
Course Enrollment	0	1013	225	1238
	1	850	186	1036
	2	4592	1266	5858
	3	2599	1147	3746
Total		9055	2824	11879

Table A.21 Mean Course Level Enrollment by Participation in the Arts

Arts	Mean	N	Std. Deviation
0	1.96	7633	.906
1	2.14	4246	.894
Total	2.02	11879	.906

Table A.22. Mean Course Level Enrollment by Participation in Sports

Sports	Mean	N	Std. Deviation
0	1.93	5509	.922
1	2.10	6370	.884
Total	2.02	11879	.906

Table A.23. Mean Course Level Enrollment by Participation in a Religious Group

Religious Group	Mean	N	Std. Deviation
0	1.99	5799	.916
1	2.05	6080	.895
Total	2.02	11879	.906

Table A.24. Mean Course Level Enrollment by Participation in Another Club

Another Club	Mean	N	Std. Deviation
0	2.00	9227	.905
1	2.08	2652	.905
Total	2.02	11879	.906

Table A.25. Mean Course Level Enrollment by Participation in an Academic Program

Academic Program	Mean	N	Std. Deviation
0	2.02	10012	.905
1	2.04	1867	.909
Total	2.02	11879	.906

Table A.26. Mean Course Level Enrollment by Participation in a Mathematics or Science Camp

Math or Science Camp	Mean	N	Std. Deviation
0	2.01	11432	.904
1	2.28	447	.914
Total	2.02	11879	.906

Table A.27. Mean Course Level Enrollment by Participation in Another Camp

Another Camp	Mean	N	Std. Deviation
0	1.97	9055	.911
1	2.18	2824	.871
Total	2.02	11879	.906

Table A.28. Mean Course Level Enrollment by Participation in a School Meeting

School Meeting	Mean	N	Std. Deviation
0	1.88	2396	.897
1	2.05	9627	.907
Total	2.02	12023	.907

Table A.29. Mean Course Level Enrollment by Participation in Another School Meeting

Another School Meeting	Mean	N	Std. Deviation
0	2.01	7971	.897
1	2.03	4026	.926
Total	2.02	11997	.907

Table A.30. Mean Course Level Enrollment by Participation in Parent/Teacher Conferences

P/T Conferences	Mean	N	Std. Deviation
0	2.02	5561	.908
1	2.01	6425	.906
Total	2.02	11986	.907

Table A.31. Mean Course Level Enrollment by Participation in Another School Event

Another School Event	Mean	N	Std. Deviation
0	1.88	4276	.929
1	2.09	7747	.886
Total	2.02	12023	.907

Table A.32. Mean Course Level Enrollment by Participation as a School Volunteer

School Volunteer	Mean	N	Std. Deviation
0	1.98	9138	.904
1	2.14	2879	.904
Total	2.02	12017	.907

Table A.33. Mean Course Level Enrollment by Participation in a School Fundraiser

School Fundraiser	Mean	N	Std. Deviation
0	1.93	6335	.914
1	2.11	5681	.889
Total	2.02	12016	.907

Table A.34. Mean Course Level in Enrollment by Meeting with a School Counselor

Mtg with a School Counselor	Mean	N	Std. Deviation
0	2.04	6948	.895
1	1.98	5051	.923
Total	2.02	11999	.907

Table A.35. Mean Course Level Enrollment by Taking Child to a Museum

Museum	Mean	N	Std. Deviation
0	1.95	5821	.915
1	2.08	6138	.895
Total	2.02	11959	.907

Table A.36. Mean Course Level Enrollment by Working with Child on Computer

Computer	Mean	N	Std. Deviation
0	1.94	1690	.936
1	2.03	10269	.902
Total	2.02	11959	.907

Table A.37. Mean Course Level Enrollment by Fixing Something with Child

Fixed Something	Mean	N	Std. Deviation
0	2.03	6445	.904
1	2.00	5514	.911
Total	2.02	11959	.907

Table A.38. Mean Course Level Enrollment by Attending School Science Fair

Science Fair	Mean	N	Std. Deviation
0	2.00	10101	.904
1	2.11	1858	.919
Total	2.02	11959	.907

Table A.39. Mean Course Level Enrollment by Helping with Science Project

Science Project	Mean	N	Std. Deviation
0	2.03	7438	.903
1	2.00	4521	.914
Total	2.02	11959	.907

Table A.40. Mean Course Level Enrollment by Discussing STEM Related Issues

STEM	Mean	N	Std. Deviation
0	1.92	4202	.923
1	2.07	7757	.895
Total	2.02	11959	.907

Table A.41. Mean Course Level Enrollment by Going to the Library

Library	Mean	N	Std. Deviation
0	1.97	4344	.891
1	2.04	7615	.916
Total	2.02	11959	.907

Table A.42. Mean Course Level Enrollment by Attending a Live Show

Live Show	Mean	N	Std. Deviation
0	1.90	4768	.914
1	2.10	7191	.895
Total	2.02	11959	.907

APPENDIX B: PARENT QUESTIONNAIRE

U.S.Department of Education High School Longitudinal Study of 2009
National Center for Education Statistics OMB No:850 0852

*Questions marked with an asterisk (*) were not asked of all respondents.
~~~~~~
SECTION E:Parent.'s Involvement
~~~~~~
Next we have some questions about your involvement in [your 9th grader].'s school, education and[his/her] home life.
~~~~~~
Is [your 9th grader's school] a regularly assigned school or a school that you chose?
Assigned
Chosen,or
[your 9th grader] was assigned to [your 9th grader's school], but you would have chosen it if you had a choice.
~~~~~~
Since the beginning of this school year (2009-2010), have you or other adults in your household...
Attended a general school meeting such as an open house or a back to school night?
Yes
No
Attended a meeting of the parent teacher organization or association?
Yes
No
Gone to a regularly scheduled parent teacher conference with [your 9th grader].'s teacher?
Yes
No
Attended a school or class event such as a play, dance, sports event or science fair because of [your 9th grader]?
Yes
No
Served as a volunteer in [your 9th grader].'s classroom or elsewhere in the school?
Yes
No
Participated in fundraising for the school?
Yes
No
Met with a school counselor in person?
Yes
No
~~~~~~
~~~~~~

During this school year, about how many days in an average week do you or another adult in your household help [your 9th grader] with homework? Would you say...
never
less than once a week
1 or 2 days a week
3 or 4 days a week or
5 or more days a week?

~~~~~~

How confident do you feel about your ability to help [your 9th grader] with the homework [he/she] has this year in each of the following subjects?
Math
Very confident
Somewhat confident
Not at all confident

~~~~~~

In general, how would you compare males and females in the following subjects?
Math
Females are much better
Females are somewhat better
Females and males are the same
Males are somewhat better
Males are much better

~~~~~~During the last 12 months, has [your 9th grader] participated in any of the following activities outside of school?
(Check all that apply.)
Music, dance, art, or theater
Organized sports supervised by an adult
Religious youth group or religious instruction
Scouting or another group or club activity
Academic instruction outside of school such as from a Saturday Academy, learning center, personal tutor or summer school program
A math or science camp
Another camp
None of these

~~~~~~

During the last 12 months, which of the following activities have you or another family member done with[your 9th grader]?
(Check all that apply.)
Visited a zoo, planetarium, natural history museum, transportation museum, or a similar museum
Worked or played on a computer together
Built or fixed something such as a vehicle or appliance
Attended a school science fair
Helped [your 9th grader] with a school science fair project
Discussed a program or article about math, science, or technology

Visited a library
Gone to a play, concert, or other live show
None of these
~~~~~~
~~~~~~

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