FAMILY CONTEXT INFLUENCE ON COLLEGE ENTRY MATH PROFICIENCY AMONG FIRST-GENERATION STUDENTS

A thesis submitted to the
Kent State University College of Education, Health, and Human Services in partial fulfillment of the requirements for the degree of Master of Arts

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The purpose of this study was to utilize an ecological perspective to examine how parent-adolescent relationship quality (microsystem), parental involvement (mesosystem), and parental employment characteristics (exosystem) relate to math proficiency at college entry for first-generation students. The participants in this study were 107 freshman first-generation college students from Kent State University. The majority of the sample resided with both parents during high school, 37 resided with just their mother, and five resided with just their father during high school. The participants completed several measures to retroactively assess the parent-adolescent relationship quality, parental involvement, and parental employment characteristic of the parent(s) they resided with during high school. In addition, a pre-college math coursework, college mathematics, and a demographic measure were completed as well by the participants. The results were correlated with their placement into math courses upon matriculation to determine what factors relate to math proficiency. Findings indicate a parent-adolescent relationship quality variable for mother's and father's are related to math proficiency at college entry for first-generation students. Overall, the variables of the parental-adolescent relationship quality are salient indicators of math proficiency for first-generation students.
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CHAPTER I

INTRODUCTION

Over the past several years, there has been an increase in post-secondary education enrollment due to the economic downturn, and more job opportunities requiring at least a college degree or an advanced degree. Earning a college degree has transformed from an option to a requirement in order to maintain a competitive edge in the economy. In the United States, postsecondary education is seen as an essential source to gain and maintain upward mobility (Haskins, Holzer, & Lerman, 2009). In 2010, adults with a bachelor’s degree earned twice as much annually as adults with only a high school diploma (National Center for Education Statistics, 2011).

While post-secondary education is a vital tool for success in the United States, it can be a cumbersome and almost impossible undertaking for a select population: first-generation students. First-generation students are defined as children of parents who have never earned a bachelor’s degree (Higher Education Opportunity Act, 2008). These students face barriers to access and college completion even before arriving on campus their freshman year. Specifically, first-generation students may be at a disadvantage compared to their counterparts when preparing for college due to lack of parental guidance, limited financial support, unfamiliarity with the college process, and academic limitations (Adelman, 2006; Choy, 2001; Horn & Nunez, 2000). However, first-generation student access to higher education has increased over the years (Engle & Tinto, 2008).
Although more first-generation students are gaining access to higher education, not all of them are persisting through and graduating. First-generation students are 26% more likely to leave college after their first year compared to non-first-generation students (Engle & Tinto, 2008). One factor that contributes to this statistic is a lack of academic preparation, particularly in mathematics. Mathematics is the most required developmental course for first-generation students (National Center for Education Statistics, 2011). Developmental math courses, which do not count as credits towards graduation, are designed to re-teach topics and concepts already taught in high school to prepare students for their required college-level mathematic coursework. First-generation students who are required to take developmental math courses are entering college already lagging behind, in addition to spending extra time and money, the latter of which is a barrier even before enrolling in college. Enrollment in developmental math was found to be one of the strongest factors negatively correlated to student persistence (Hawley & Harris, 2005). This could be for two reasons: developmental math can prolong graduation due to the mathematic prerequisites required for particular courses; or students may discover that developmental math is very challenging and they cannot pass the course. Failure in developmental math signifies a prime barrier to student retention (Noel-Levitz, 2005). Consequently, it is imperative that first-generation students arrive at college with the requisite mathematical skills, since mathematic proficiency at time of entry greatly influences retention and persistence through college.

Prior research has examined the influence of parents, educators, and pre-college coursework in contributing to student math proficiency at college entry (Horn & Bobbitt,
2000). These factors play an interrelated role because the central premise is that encouraging students to take algebra in middle school and/or to select higher level mathematic courses in high school will reduce the future likelihood of enrolling in developmental math. Enrollment in these courses ensures that students are taking rigorous coursework in preparation for college. Understanding course selection requires a theoretical perspective which examines how first-generation students’ interactions within families and schools influence math proficiency. A human ecological systems framework describes human development through the interrelationships of multiple environments and their effects on the developing individual (Brofenbrenner, 1979). Utilizing this perspective, one can identify several factors which may impact an adolescent’s math proficiency at college entry. For example, parental support, teacher encouragement, and school counselors each may be influential. While each of these has been examined as independent predictors of math proficiency, prior research has failed to collectively integrate multiple ecological factors in predicting math proficiency.

**Statement of Purpose**

The purpose of this study was to utilize an ecological perspective to determine factors predicting math proficiency at college entry for first generations students. Elements of the microsystem, mesosystem, and exosystem were considered with regard to their influence on math proficiency. The intended outcome was to provide a foundation for creating an intervention program to assist first-generation families in successfully preparing their students for entry into college-level mathematics courses.
Research Questions

Refer to figure 1 to further illustrate the research questions.

- Are parent-adolescent relationship quality, parental involvement, and parental workplace characteristics related to math proficiency at college entry among first-generation students?
- Are parent-adolescent relationship quality, parental involvement, parental workplace characteristics, and enrollment in advanced math courses in high school related to math proficiency at college entry among first-generation students?
- Is the relationship between parent-adolescent relationship quality, parental involvement, parental employment characteristics and college entry math proficiency mediated by high school enrollment in advanced math classes among first-generation students?
Figure 1
Theoretical Framework Model
Operational Definitions

Parent-adolescent relationship quality-The variable was defined as a score on a standardized self-report measure of relationship quality.

Parental Involvement- This variable was defined as a student’s report of his or her parent’s involvement which includes: tracking student’s progress in math, providing direct assistance, encouraging teacher support, coordinating tutoring sessions, and emphasizing the importance of mathematics.

Parental Employment Characteristics- This was defined as a student’s description of five characteristics of his or her parent’s employment: the shift worked, number of work days in a week, and three work-family balance tasks.

Math proficiency at college entry- This was defined as the level of math placed into as a matriculating college freshman.

Enrollment in advanced math courses- This was defined as a student’s self-report of advanced math course(s) taken in high school.
CHAPTER II

REVIEW OF LITERATURE

College Access Barriers

First-generation students are defined as children of parents who have not obtained a bachelor’s degree (Higher Education Opportunity Act, 2008). Previous studies have presented empirical research which identifies barriers that prevent first-generation students from gaining access to college. One of the primary barriers for college access is parental education. Even after controlling for demographic factors such as family income, parental involvement, and academic preparation (Horn & Nunez, 2000), limited parental education is still viewed as a risk factor for first-generation students attending college (Choy, 2001). According to Choy, altering the status of a parent’s education level is impossible, so exploring variables related to parental education can help first-generation students overcome access barriers (2001).

Lack of participation in a rigorous high school curriculum is a barrier related to parental education. Student enrollment in a rigorous high school curriculum, particularly one that includes advanced math, increases the odds of enrolling in college (Choy, 2001; Engle, Bermeo, & O’Brian, 2006; Horn & Nunez, 2000). First-generation students are less likely than their counterparts to take a rigorous high school curriculum due to the lack of availability of courses at their school and the lack of encouragement and involvement from their parents and school in selecting a rigorous curriculum (Choy, 2001; Horn & Nunez, 2000). Some parents are not aware that a rigorous high school program aids in adolescent college enrollment. Providing outreach programs that assist
parents in understanding the correlation between rigorous high school curriculum and college access and success may help first-generation students increase their academic confidence and preparation as matriculating freshmen.

In addition to providing limited encouragement and support in college preparatory curriculum, first-generation parents are unfamiliar with the college process. Therefore there is a disconnect between encouraging students to attend (Engle, 2006; Terenzini, Springer, Yaeger, Pascarella, & Nora, 1996) and providing them with accurate sources and procedures to apply for college (Adelman, 2006; Choy, 2001; Horn & Nunez, 2000). First-generation parents lack the knowledge and experience to help their students in the college admission and financial aid process and some high schools’ counselor ratios were so low that students could not receive the assistance they needed (Choy, 2001; Engle, Bermeo, & O’Barma, 2006). According to Horn and Nunez (2000), parents without college degrees are unfamiliar with the college process but also are less likely to attend informative programs, such as college visits and sessions to attain college and financial information. Sometimes the lack of involvement in these programs is linked to parents’ busy work schedules. The result may be a lack of financial information among disadvantaged families regarding how to pay for college and the financial aid that is available for their adolescents. Low-income, African-American, and Latino families are unaware of the cost to attend college and tend to underemphasize the amount of financial aid accessible for college students (A shared agenda, 2004). Yet, providing first-generation students with adequate resources to attend college can aid in eliminating barriers to access postsecondary opportunities. As time has progressed, more
first-generation students are gaining access to higher education (Engle & Tinto, 2008).

**Persistence and Retention**

Although more first-generation students are gaining access to higher education, not all of them are persisting through and graduating. According to Chen’s study in 2005, 43% of first-generation students left without earning a bachelor degree compared to 20% of their counterparts. One factor that contributes to this statistic is a lack of academic preparation, particularly in mathematics. Based on previous studies, first-generation students lack academic preparation in rigorous coursework, especially in mathematics (Adelman, 1999; Choy, 2001; Horn & Nunez, 2000; Ishitani 2003; U.S. Department of Education, 2005a). Some first-generation students are not enrolling in the high school courses to academically prepare them for college level mathematics. The significant pre-college coursework can begin as early as eighth grade. When first-generation students enroll in algebra in the eighth grade, it increases the likelihood they will enroll in more challenging higher-level math courses in high school (Adelman, 1999, 2006; Choy, 2001; Horn & Nunez, 2000). However, the population of first-generation students who actually enroll in algebra during eighth grade is less than their counterparts; 34% of first-generation students versus 55% of non-first-generation students enrolled in algebra in eighth grade (Choy, 2001). The difference in the percentage may be at least partly due to the lack of encouragement first-generation students receive from their parents.
According to previous studies, there is a positive relationship between parents’ education level and supporting their adolescents in choosing appropriate math courses that will academically prepare them for college access and success (Adelman, 2006, 1999; Horn & Nunez, 2000). Parents that have a college degree are more likely to encourage their students to take higher level math courses versus parents without a college degree. Some parents without a college degree lack the knowledge and understanding of necessary planning of rigorous coursework to be academically prepared for college (Martinez & Klopott, 2005; Warburton, Bugarin, & Nunez, 2001).

According to Horn and Nunez (2000) 52% of first-generation parents encouraged their adolescent to enroll in algebra in eighth grade compared to 70% of non-first-generation parents. Thus, parents’ education level is one factor that influences whether adolescents enroll in algebra in eighth grade, which is considered the gateway course in taking higher-level math courses in high school (Choy, 2001).

Another relevant issue is the lack of course availability at schools with disadvantaged students. Some schools that first-generation students attend do not offer algebra, thereby placing these students at a disadvantage as first-generation students since algebra is considered the gateway course to more advanced math courses (Engle, 2006). According to Choy (2001), students who take algebra in the eighth grade are 83% more likely to take advanced math classes in high school. Therefore, parents and counselors need to ensure first-generation students are equipped with the necessary eighth grade coursework to prepare for advanced high school math courses, which ultimately impacts their academic preparation for college access and matriculation to a degree.
When first-generation students enter high school, they still have the opportunity to enroll in advanced math courses that will increase their likelihood of entering college as well as preventing deferment to developmental math courses in college. If first-generation students take a combination or at least one of the following courses: algebra II, trigonometry, pre-calculus, and calculus, this correlates to academic success in college (Adelman, 2006, 1999; Trusty & Niles, 2003). Conversely, a lack of academic preparation, particularly in math, for first-generation students can be one factor that leads to the large percentage of this group requiring developmental math (National Center for Education Statistics, 2011). Developmental math courses, which do not count as credits towards graduation, are designed to re-teach topics and concepts already taught in high school to prepare students for their required college-level mathematic coursework. First-generation students are more likely than non-first-generation students to take remedial courses during enrollment in postsecondary education (Chen, 2005; Pascarella et al., 2003, 2004; Terenzini et al., 1996; Warburton et al., 2001). More specifically, according to research conducted by Chen and Caroll (2005), 40% of first-generation students were enrolled in developmental math, compared to 16% of their counterparts.

**Developmental Math Coursework**

First-generation students who are required to take developmental math courses are entering college already lagging behind, in addition to spending extra time and money, the latter of which is a barrier even before enrolling in college. Enrollment in developmental math was found to be one of the strongest factors negatively correlated to student persistence (Hawley & Harris, 2005). This could be for one of two reasons:
developmental math can prolong graduation due to the mathematic prerequisites required for particular courses; or students may discover that developmental math is very challenging and they cannot pass the course. Failure in developmental math signifies a prime barrier to student retention (Noel-Levitz, 2005). Consequently, it is imperative that first-generation students arrive at college with the requisite mathematical skills, since mathematic proficiency at time of entry greatly influences retention and persistence through college. In order to explore the interaction of the most imperative environments that affect first-generation students’ academic achievement, an ecological perspective should be implemented.

**Human Ecological Theoretical Framework**

The human ecological theory developed by Brofenbrenner (1979) explores how interactions within multiple environments can impact the developing individual. Brofenbrenner’s ecological theory consists of four environments which are the microsystem, mesosystem, and exosystem. For purposes of the present study selected elements of the microsystem, mesosystem, and the exosystem were utilized. The microsystem represents the immediate environment of the adolescents such as families and schools. The mesosystem is the interactions between two or more environments within the microsystem, for instance the link between school and home. And lastly, the exosystem consists of environments adolescents do not directly engage in, yet that impact their development, such as parental employment.
Microsystem

One component of the microsystem relevant to the current study is the quality of the parent-adolescent relationship. Previous studies have investigated how the type of parenting approach impacts adolescents' academic achievement, and the results allude to authoritative parenting characteristics influencing academic achievement. According to Steinberg et al. (1991), there is a positive relationship between authoritative parenting and academic success. This point is consistent with other studies that do not directly reference authoritative parenting but imply that characteristics of this parenting approach contribute to academic success, higher g.p.a.’s, and higher school performance. Although different researchers utilize differing terminology, all essentially conclude that authoritative parenting correlates to academic success. Parents that are affectionate and approachable (Moore, Guzman, Hair, & Garrett, 2004; Simpson, 2001) and create a supportive (Simpson, 2001) environment where adolescents feel they are developing trusting relationships (Pong, Hao, & Gardner, 2005) will contribute to academic success. These characteristics suggest that authoritative parents are understanding and willing to compromise with adolescents. More specifically, one study examined the quality of the parent-adolescent relationship and concluded that higher quality relationships tend to contribute to adolescents achieving good grades (Hair, Moore, Garret, Kinukawa, Lippman, & Michelson, 2004). Adolescents benefit greatly when parents exemplify a nurturing, affectionate environment and spend quality time with them, which leads to higher academic achievement (Yan & Lin, 2012).
The prior research on parent-adolescent relationships has focused on the correlation between parenting styles and overall academic achievement while overlooking math proficiency as a specific outcome. One exception is the work of Moore and colleagues (2001) which examined how parent-adolescent relationships correlate to math proficiency. The results of the research indicated that when parents have conversations about social science and politics adolescents’ math proficiency tends to increase.

Even though communication between parents and adolescents is imperative, parents need to keep in mind that general conversation can be utilized as a gateway to implement more beneficial conversations. Open communication with parents can influence adolescents to seek help with challenging academic coursework (Hamre & Pianta, 2001). Communication can prompt adolescents to ask for assistance and incorporate parental involvement.

Missing from previous research is consideration of the more general quality of the parent-adolescent relationship and its correlation to academic success of math proficiency. The present study examined the quality of parent-adolescent relationships in relation to college entry math proficiency among first-generation students. Relationship quality was evaluated in a self-report scale completed by the student.

**Mesosystem**

Parental involvement with academic school work represents an interaction between two microsystems and therefore constitutes an element of the mesosystem. Numerous studies have identified that parental involvement positively impacts students’
achievement (Domina, 2005; Fan, 2001; Griffith, 1998; Hubbard, 1999; Sheldon & Epstein, 2005; Sirvani, 2007b; Spera, 2005). On the contrary, other studies reveal that parental involvement has a negative impact on students’ achievement (Desimone, 1999; McNeal, 1999; Muller, 1998). The contradictions between the studies can be attributed to the inconsistencies in how researchers have defined parental involvement (Fan & Chen, 2001). Some of the definitions consist of different variables that allude to parental involvement; according to Singh (1995), parental involvement was defined as involvement in school activities, aspirations for education, home structure, and parent-child communication about school. Another researcher defined parental involvement as activities like communication, parenting, volunteering, community interactions, making decisions, and learning at home (Epstein, 1995).

Studies have explored parental involvement from elementary to high school and it appears that parental involvement influences academic success at all ages. According to the National Center for Education Statistics (2000), parental involvement in children’s lives tends to be greater in elementary school than in middle or high school. Even though parental involvement tends to decrease as children progress through the academic system, it still correlates to academic success during middle and high school (Epstein & Sanders, 2002; Hill et al., 2004). As adolescents are entering a period of independence where they are spending more time away from family and with friends, it is imperative that parents continue to remain active and involved in their adolescents’ social and academic endeavors.
Parental involvement has been explored in various studies by examining parent educational aspirations for their children, communication regarding school topics and activities, and direct and indirect assistance with homework. Parent educational aspirations for their adolescent has been linked to higher academic achievement (Fan, 2001; Griffith, 1998; Hong & Ho, 2005; Hubbard, 1999). When they recognize that their parents value education and aspire for them to excel, adolescents are more likely to be intrigued in school and secure in their academic work (Fan & Williams, 2010). More specifically, when parents value a particular subject, adolescents employ more effort and perform well. Having parents who value math and convey the significance of it boosts adolescents’ high school math achievement (Hong, Yoo, & Wu, 2010). The value that parents place on a particular subject can affect the learning outcome of their adolescent. According to Fan, this positive relationship between parents’ aspirations and student academic achievement was constant across all ethnic groups (2001). This suggests that even though adolescents are in a developmental transition to gain autonomy, they are still conscious of their parents’ expectations and would like to satisfy them. In fact, parents’ aspirations influence adolescents’ academic growth over time more than SES (Fan, 2001). Adolescents who reside in low-income families are not necessarily at a disadvantage in this regard and can benefit from parents who value education and their future endeavors.

As children enter into middle and high school, parents may become less directly involved with helping with homework (Zhan, 2006). This reduced direct involvement can be generated by inadequacies of parents’ knowledge on the subject; as adolescents progress, the coursework becomes more intense (Muller, 1998). One specific subject
area in which this pattern occurs is mathematics. As adolescents progress to more advanced math courses, it may be more challenging for parents to assist with homework because they are not familiar with the concepts and formula (Patel, Cooper, & Robinson, 2008). Some authors suggest that indirect parental involvement is more developmentally appropriate for adolescents. For example, when parents provide encouragement and assist students in managing their homework their adolescents produce more precise homework. This in turn contributes to fewer arguments over homework which leads to higher grades (Zhan, 2006).

Another form of non-direct parental involvement consists of establishing rules regarding when and where homework should be done which bears a very strong positive relationship to achievement (Patel, Cooper, & Robinson, 2008). There are many positive outcomes that can result from setting homework rules such as creating a routine that adolescents love and helping to develop self-regulation. However, when parents monitor homework there tends to be a negative effect on student achievement (Patel et al., 2008). Adolescents may feel they are not gaining independence and their parents do not trust them to complete homework on their own. If utilized without clear guidelines adolescents could perceive this form of parental involvement as a form of control (Patel et al., 2008). This contributes to a negative correlation between involvement and academic achievement.

Communication about school content or matters between parents and adolescents relates to academic achievement. During middle and high school, academic outcomes of adolescents positively correlate with parents conversing about school and future plans
(Epstein & Sander, 2002; Yonezawa, 2000). The more frequent conversations parents employ with adolescents, the higher the impact on academic achievement (Jeynes, 2005). Even though adolescents may convey lack of interest in discussing school related matters as they are evolving through the phase of adolescence, parents should nevertheless keep the line of communication open in order to benefit academic achievement outcomes.

Research studies have examined various aspects of parental involvement and the correlation to academic success. However, limited research focuses on the direct correlation of parental involvement and math proficiency.

The present study defined parental involvement using several variables from prior research: tracking student’s progress in math, providing direct assistance, and emphasizing the importance of mathematics. This study also introduced additional components of parental involvement that may contribute to mathematic proficiency, such as encouraging adolescents to get support from their teacher and coordinating tutoring sessions if they are struggling in a mathematics course. These additional components may be of significance in light of previous findings that parental involvement tends to decrease as students’ mathematic courses become more difficult.

**Exosystem**

One component of the exosystem relevant to the present study is parental employment characteristics. The literature on parental employment impact on adolescent academic achievement is limited and outdated. More specifically, the research examines the effect of maternal employment on adolescent’s academic achievement. Research has proven that parental employment does not have a direct impact on academic
achievement; however, indirect effects have been shown. These indirect effects include attitudes about maternal employment (Paulson, 1996) and how the structure of the family is affected (Muller, 1995). The behaviors mothers implemented were influenced by their attitudes. Specifically, if mothers’ attitude and work status were consistent then the mothers displayed a positive attitude toward their adolescents’ achievement. On the contrary, if the mothers’ attitudes about work and their employment status were inconsistent the mothers displayed a negative attitude toward their adolescents’ academic achievement. Mothers that worked full-time and displayed a positive attitude about working were more interested in being involved in their adolescents’ achievement. Thus, the overall results suggest that adolescent achievement is positively influenced by parental involvement in schoolwork (Paulson, 1995), which in turn is influenced by mothers’ attitudes about their employment.

Muller (1995) concluded there was no difference in adolescents’ mathematic achievement, regardless of whether their mother worked full-time or was not employed, after controlling for unsupervised time. This suggests that the amount of unsupervised time influences the effect of maternal employment on adolescents’ mathematic achievement. In addition, mothers working part-time were more involved than both non-employed and full-time employed mothers with their adolescents’ schooling which influenced the adolescents to achieve a higher mathematic achievement score. The differences can be attributed to the parents’ interest in being involved, the amount of available resources, and their educational aspirations for their children (Muller, 1995). There is very limited research on the influence of characteristics of parental employment
on adolescents’ academic success, and more specifically their mathematic proficiency. Furthermore, research that does exist has considered employment status only and has not directly examined specific parental employment characteristics and how those may positively or negatively impact adolescent mathematic proficiency. The present study addressed this void by exploring specific parental employment characteristics: type of job, shifts worked, the number of days worked each week, flex time, and work-family balance. It is noteworthy that all these components of parental employment may influence the amount of parental involvement in their adolescents’ schooling as well as the quality of parent-adolescent relationship. Thus, consistent with a human ecological system perspective, multiple environments are interrelated and collectively cultivate an adolescent’s development.

There is limited research on the three family context factors and their association with enrollment in an advanced math class during high school. Previous research found that parent-adolescent interactions are associated with enrollment during high school (Horn & Nunez, 2000). This is the only research that associates one of the three family context factors to enrollment in an advanced math class during high school. This present study examined specific parent-adolescent interactions that are associated with enrollment in advanced math during high school, as well as the parental employment characteristics and parental involvement.
Summary

In sum, first-generation students are gaining more access to higher education than in previous years; the current issue is retention and persistence. One of the factors contributing to this current issue is a lack of academic preparedness for college level mathematics. There is a strong possibility that first-generation students who begin in developmental math courses are less likely to retain to the next year and persist to graduation. Therefore, first-generation students need to be academically prepared and begin college level mathematics as a matriculating college freshman.

In order for first-generation students to be prepared academically for mathematics at college entry, they must enroll in a pre-college curriculum. Interactions within their microsystem, mesosystem, and exosystem should work simultaneously to ensure that first-generation students have the support needed to achieve the necessary academic preparation to begin college level mathematics.

The interrelationships between the microsystem, mesosystem, and the exosystem play a role in adolescents’ academic achievement. The quality of parent-adolescent relationships and parental involvement positively impact adolescents’ academic achievement. When the quality of the parent-adolescent relationship is high, it tends to lead to higher academic achievement for adolescents. Parental educational aspirations, indirect parental involvement with homework and communication about school all contribute positively to adolescents’ academic achievement. Even though parental involvement tends to decrease as adolescents enter high school, it still correlates to academic achievement in high school.
Limited existing research on parental employment characteristics in relation to adolescents’ academic achievement has explored characteristics of work that impacted the amount of involvement mothers had with their adolescents. When mothers are consistent in their work attitudes and work status they display a positive attitude towards adolescents’ achievement. Furthermore, the amount of time adolescents spend unsupervised can impact their mathematic achievement.

Researchers have not explored collective contributors of parent-adolescent relationship quality, parental involvement, and parental employment characteristics to adolescents’ mathematic achievement. As a result, the existing literature lacks a holistic perspective that examines multiple factors influencing math proficiency at college entry for first-generation students. The present study utilized an ecological perspective to determine factors predicting math proficiency at college entry for first generations students. Elements of the microsystem, mesosystem, and ecosystem were considered with regard to their influence on math proficiency.
CHAPTER III

METHODOLOGY

Sample

First-generation freshmen students were recruited from a public, four-year university. The sample included 107 first-generation students who completed an online survey. Females greatly outnumbered males in this study, comprising 88.2% (n=88) of respondents versus 17.8% (n=19) of respondents who were males. The age of respondents ranged from 18-20 years old, with a median age of 18.93. Approximately 82.2 % (n=88) of respondents were Caucasian, while 9.3% (n=10) of respondents reported an ethnic identity of "other," 6.5% (n=7) were African American, and 1.9% (n=2) American Indian or Alaskan Native. The largest percentage 60.7% (n=65) of respondents lived with both parents during high school, followed by 34.6% (n=37) of respondents who reported living with their mother during high school, and 4.7% (n=5) of respondents reported living with their father during high school.

Procedures

Participants were recruited from four of the Kent Core Category Courses. Fourteen professors were sent an email which included the purpose of the study and asked if they were willing to distribute an email invitation to the students enrolled in their course, to participate in an online study. Four professors confirmed they would assist in distributing the survey. Once the professor confirmed, an email invitation was sent to the cooperating professor to send to all the students, which included a link to the online
survey. All students were able to complete the survey; however, for purposes of this study only first-generation students' responses were utilized. Participants had one week to complete the survey. Five days after the professor confirmed to assist in distributing the survey, a reminder email was sent to the professor to forward to the students to inform the students of the completion date. In addition, the Director of the Research, Planning, and Institutional Effectiveness Office was contacted and he provided email addresses of all full-time, freshman first-generation students. Once the email addresses were received, an email invitation was sent to all the first-generation students. Five days after the initial contact, a reminder email was sent to inform students of the completion date. 

**Measures**

This study utilized six measures to assess what family context factors influence math proficiency at college entry for first-generation students. The fourteen item Parent-Adolescent Relationship Quality (PARQ) (Appendix A) measure was developed for this study based on modifications from several existing scales. Items one through four were derived from Weiss’s (1993) importance of relationships with parents scale. Question five was modified from Risman and Kyung’s (1988) scale of parent-child relationships in single-parent homes. Finally, question six was derived from the review of literature on parenting styles and its influence on academic achievement. Six items reflect the mother-adolescent relationship quality and the other six reflect the father-adolescent relationship quality. Scale items one through five asked respondents to individually self-report the relationship quality with their mother and/or father using a seven-point Likert scale ranging from never to daily. Sample items include: “While in high school how often did
you and your mother/father spend time together,” “While in high school, how often did you and your mother/father get along.” The respondent’s mother and/or father parent-adolescent relationship quality score was individually calculated by converting the seven point Likert scale to a numerical value ranging from zero (never) to seven (daily), then the responses to the first ten items, five for mothers and five for fathers, were totaled and divided by five to derive the composite score. A high score indicated a high quality parent-adolescent relationship. The Cronbach alpha for the PARQ measure was .81.

The last PARQ item asked participants to recall, “Which of the following best describes the type of parenting style your mother/father displayed towards you in high school?” The respondents rated their parents by choosing one of the four descriptions to identify the parenting style that resembled their mother and/or father during high school. The four parenting styles are: authoritarian, authoritative, permissive, and neglectful. This item was coded to create a dichotomous variable: authoritative parenting versus non authoritative parenting.

The Parental Involvement Measure (PI) (Appendix B) was developed based on the operational definition of parental involvement outlined in the review of literature and contained ten items. Five items reflected the mother's involvement and the other five items reflected the father's mathematics-related with the adolescent during high school. Questions one through four ask respondents to utilize a seven-point Likert scale ranging from never to daily to answer the scale items. Sample items include: “How often did your mother /father emphasize the importance of mathematics in high school” and "How often did your mother/father ask about your math classes in high school." The
respondent’s mother and/or father parental involvement score was individually calculated by converting the seven point Likert scale to a numerical value ranging from zero (never) to seven (daily), then the responses to the four items for each parent were totaled and divided by four to derive the composite score. A high score indicated a high level of parental involvement. The Cronbach alpha for the PI measure was .83.

Item five of this measure asked, “When you needed assistance in mathematics in high school, how did your mother/father provide assistance?” Respondents selected one of the five choices: encouraged me to ask my teacher for help; arranged tutoring sessions for me; helped me with math assignments herself/himself; my mother/father did not provide assistance; and other. For this question the response categories were derived from the review of literature, which suggests parents implement indirect assistance with homework for adolescents. When coding this item, a dichotomous variable was created: direct versus indirect assistance. Direct assistance is defined as the parent helping with assignments and indirect assistance is defined as the parent encouraging students to receive help from others.

The Parental Employment Characteristic measure (PEC) (Appendix C), developed for purposes of this study, asked respondents to report their parents' employment situation during their time in high school. The twelve items for this measure include six that reflect mother's employment characteristics and the other six reflect the father's employment characteristics. The first three items involve respondents indicating
the work status, schedule, and shift of their mother and/or father during high school, based on the provided choices. Sample items include: “While in high school, what was your mother’s/father’s work status?” and “While in high school, what schedule best reflected the amount of days your mother/father worked in a week?” The first three items were scored by creating a dichotomous variable: standard hours versus non-standard hours. Standard hours are defined as a full or part-time morning shift on Monday-Friday. All of the other combinations of shifts, status, and schedules are defined as non-standard work hours. The last three items asked respondents to use a seven-point Likert scale, ranging from never to daily, to indicate the parent's work-family balance. Sample items include: “While in high school how often did your mother/father talk with enthusiasm about his/her job?” and “While in high school how often did your mother/father engage in work assignments at home?” The Cronbach alpha for the work-family balance items was .179. Given the Cronbach alpha was low each item was separately analyzed as a variable.

The College Mathematics measure (Appendix D) determined whether the respondent enrolled in a college-level math course during their first or second semester as a freshman. This three item instrument asked respondents to report their math course(s) during their first year of college. Sample items include: “What math course(s) were you enrolled in during your first semester?” “If you did not enroll in a math course your first semester, please select the math course you are currently enrolled in this semester?” This item was coded by creating a dichotomous variable: college level mathematics versus developmental math.
The Pre-College Math Coursework measure (Appendix E) was developed utilizing the review of literature for purposes of this study. This instrument contains five items to assess the respondent’s enrollment in advanced math classes during high school. Sample scale items include: “Did you take algebra in eighth grade?” and “What math classes did you take in high school?” This item was coded by creating a dichotomous variable: enrollment in at least one advanced math class versus enrollment in non-advanced classes. Non-advanced math courses are algebra I and II, and integrated math.

A demographic assessment (Appendix F) five-item measure was developed to obtain general information about the respondents. Sample items include: "Did either one of your parents graduate from college with a bachelor’s degree" and “While in high school what adults did you live with?”

Data Analysis

Table 1 lists the variables derived from the study theoretical model, measures and indicates the variable types. Correlational analyses were conducted to examine the bivariate relationships between each family context variable (parental-adolescent relationship quality, parental involvement, and parental employment characteristics) and math proficiency at college entry; similarly, bivariate relationships between family context variables and pre-college math coursework were examined. These analyses were conducted separately for mothers and fathers. To refine the examination of each family context variable in relation to adolescent math proficiency and pre college coursework, a
second set of correlational analyses were conducted utilizing each individual item from the PARQ, PI, and PEC measures. When conducting these analyses, if one variable was dichotomous (e.g., college level math versus developmental math), point bi-serial correlations were computed. When both variables were dichotomous, chi-square analysis was conducted.

After the correlational bivariate relationships were examined, a logistic regression analysis was conducted to examine the relative influence of family context, parental employment variables, and enrollment in an advanced math class in high school for predicting math proficiency at college entry.
<table>
<thead>
<tr>
<th>Ecological System</th>
<th>Measure</th>
<th>Operational Definition</th>
<th>Variable Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Microsystem</td>
<td>PARQ</td>
<td>Composite Score</td>
<td>Interval</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Parenting Style</td>
<td>Dichotomous</td>
</tr>
<tr>
<td>Mesosystem</td>
<td>PI</td>
<td>Composite Score</td>
<td>Interval</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Indirect vs. Direct Assistance</td>
<td>Dichotomous</td>
</tr>
<tr>
<td>Exosystem</td>
<td>PEC</td>
<td>Monday - Friday vs. Non Monday - Friday Schedule</td>
<td>Dichotomous</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Morning vs. Non Morning Shift</td>
<td>Dichotomous</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Standard vs. Non Standard Hours</td>
<td>Dichotomous</td>
</tr>
<tr>
<td></td>
<td>PEC (individual Items)</td>
<td>Talk with enthusiasm about job</td>
<td>Interval</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Engage in work assignments at home</td>
<td>Interval</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Stressed from work</td>
<td>Interval</td>
</tr>
</tbody>
</table>
CHAPTER IV

RESULTS

In the presentation of results, the analyses for mothers and fathers are listed together by research questions.

Descriptive Results for Adolescents Residing with their Mother

Table 2 reports descriptive results for pre-college coursework and math proficiency for first-generation students who lived with their mother during high school. Twenty-five first-generation students (24.5%) reported no enrollment in advanced math classes in high school and 77 first-generation students (75.5%) reported enrollment in at least once or more advanced math classes in high school. Sixty-two (60.8%) first-generation students reported placement in a developmental math course upon college entry, 36 (35.3%) reported placement in a college level math course upon entry, and 4 (3.9%) reported enrollment in a post-secondary math course during high school. Students that enrolled in a post-secondary math course during high school were eliminated from further analyses.

Table 2

*Frequencies (percentage) for Pre-College Coursework and Math Proficiency*

<table>
<thead>
<tr>
<th>Pre-College Coursework</th>
<th>Students</th>
<th>Math Proficiency</th>
<th>Students</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enrollment in an advanced math class during high school</td>
<td>77 (75.5%)</td>
<td>Developmental Math</td>
<td>62 (60.8%)</td>
</tr>
<tr>
<td>No enrollment in an advanced math class during high school</td>
<td>25 (24.5%)</td>
<td>College-level Math</td>
<td>36 (35.3%)</td>
</tr>
</tbody>
</table>
Descriptive Results for Adolescents Residing with their Father

Table 3 reports descriptive results for respondents who lived with their father during high school. 50 (71.4%) of these first-generation students reported they enrolled in an advanced math class in high school and 20 (28.6%) reported no enrollment in an advanced math course in high school. Twenty-seven first-generation students (39.7%) reported placement into a college-level math course upon entry to college and 41 first-generation student’s (60.3%) reported placement into a developmental math course upon entry to college.

Table 3
*Frequencies (percentage) for Pre-College Coursework and Math Proficiency*

<table>
<thead>
<tr>
<th>Pre-College Coursework</th>
<th>Students</th>
<th>Math Proficiency</th>
<th>Students</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enrollment in an advanced math class during high school</td>
<td>50 (71.4%)</td>
<td>Developmental Math</td>
<td>41 (60.3%)</td>
</tr>
<tr>
<td>No enrollment in an advanced math class during high school</td>
<td>20 (28.6%)</td>
<td>College-level Math</td>
<td>27 (39.7%)</td>
</tr>
</tbody>
</table>
Parent-Adolescent Relationship Quality, Parental Involvement, and Parental Employment Characteristics Related to Math Proficiency

The first research question is: Do parent-adolescent relationship quality, parental involvement, and parental employment characteristics influence math proficiency at college entry among first-generation students. Table 4 reports the results for adolescents who lived with their mother during high school. As reported in the first column of Table 3, there were no statistically significant relationships were found between the three measures and math proficiency at college entry. However, when a second set of correlational analyses were conducted for individual items of the three measures (PARG, PI, and PEC), a statistically significant relationship was found. Respondents' reports of the degree to which their mothers conversed about academics during high school is correlated to placement into a college level math course upon matriculation, $r (96) = .20$, $p < .05$. As the degree to which a mother conversed about academics during high school with her adolescent increased it is correlated to the adolescent placing into a college-level math course.
Table 4

*Mother Correlational Bivariate Relationship Analyses for Family Context Variables with Pre-College Coursework and Math Proficiency Variables*

<table>
<thead>
<tr>
<th>Predictor Variables</th>
<th>Pre-College Coursework</th>
<th>N</th>
<th>Math Proficiency</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>PARQ Score</td>
<td>.185(^a)</td>
<td>102</td>
<td>.089(^a)</td>
<td>98</td>
</tr>
<tr>
<td>Spend time</td>
<td>.221(^a*)</td>
<td>99</td>
<td>.031(^a)</td>
<td>95</td>
</tr>
<tr>
<td>Get along</td>
<td>.188(^a)</td>
<td>102</td>
<td>.069(^a)</td>
<td>92</td>
</tr>
<tr>
<td>Converse about academics</td>
<td>.102(^a)</td>
<td>102</td>
<td>.203(^a*)</td>
<td>98</td>
</tr>
<tr>
<td>Converse about social life</td>
<td>.112(^a)</td>
<td>101</td>
<td>-.019(^a)</td>
<td>97</td>
</tr>
<tr>
<td>Discuss activities</td>
<td>.246(^a*)</td>
<td>101</td>
<td>.093(^a)</td>
<td>97</td>
</tr>
<tr>
<td>Parenting style</td>
<td>3.338(^b)</td>
<td>102</td>
<td>.831(^b)</td>
<td>98</td>
</tr>
<tr>
<td>PI Score</td>
<td>-.078(^a)</td>
<td>102</td>
<td>-.019(^a)</td>
<td>98</td>
</tr>
<tr>
<td>Emphasize the importance of math</td>
<td>.001(^a)</td>
<td>102</td>
<td>.008(^a)</td>
<td>98</td>
</tr>
<tr>
<td>Ask about math classes</td>
<td>-.049(^a)</td>
<td>102</td>
<td>.103(^a)</td>
<td>98</td>
</tr>
<tr>
<td>Ask about topics</td>
<td>-.149(^a)</td>
<td>102</td>
<td>-.082(^a)</td>
<td>98</td>
</tr>
<tr>
<td>Ask if you had math homework</td>
<td>-.063(^a)</td>
<td>102</td>
<td>-.089(^a)</td>
<td>98</td>
</tr>
<tr>
<td>Predictor Variables</td>
<td>Pre-College Coursework</td>
<td>N</td>
<td>Math Proficiency</td>
<td>N</td>
</tr>
<tr>
<td>----------------------------------</td>
<td>------------------------</td>
<td>---</td>
<td>------------------</td>
<td>---</td>
</tr>
<tr>
<td>Direct vs. Indirect assistance</td>
<td>.374&lt;sup&gt;b&lt;/sup&gt;</td>
<td>70</td>
<td>.109&lt;sup&gt;b&lt;/sup&gt;</td>
<td>70</td>
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<tr>
<td>PEC</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Standard vs. Non-Standard Hours</td>
<td>1.817&lt;sup&gt;b&lt;/sup&gt;</td>
<td>94</td>
<td>2.863&lt;sup&gt;b&lt;/sup&gt;</td>
<td>98</td>
</tr>
<tr>
<td>Monday - Friday vs. non</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Monday- Friday Schedule</td>
<td>.235&lt;sup&gt;b&lt;/sup&gt;</td>
<td>93</td>
<td>.728&lt;sup&gt;b&lt;/sup&gt;</td>
<td>89</td>
</tr>
<tr>
<td>Morning vs. Non Morning shift</td>
<td>3.104&lt;sup&gt;b&lt;/sup&gt;</td>
<td>93</td>
<td>3.695&lt;sup&gt;b&lt;/sup&gt;</td>
<td>89</td>
</tr>
<tr>
<td>Talk with enthusiasm about job</td>
<td>.042&lt;sup&gt;a&lt;/sup&gt;</td>
<td>95</td>
<td>.071&lt;sup&gt;a&lt;/sup&gt;</td>
<td>91</td>
</tr>
<tr>
<td>Engage in work assignments at home</td>
<td>.144&lt;sup&gt;a&lt;/sup&gt;</td>
<td>95</td>
<td>.012&lt;sup&gt;a&lt;/sup&gt;</td>
<td>91</td>
</tr>
<tr>
<td>Stressed from work</td>
<td>-.012&lt;sup&gt;a&lt;/sup&gt;</td>
<td>94</td>
<td>-.156&lt;sup&gt;a&lt;/sup&gt;</td>
<td>90</td>
</tr>
<tr>
<td>Advanced math class</td>
<td></td>
<td></td>
<td>8.835&lt;sup&gt;b*&lt;/sup&gt;</td>
<td>98</td>
</tr>
<tr>
<td>Gender</td>
<td>2.121&lt;sup&gt;b&lt;/sup&gt;</td>
<td>102</td>
<td>12.048&lt;sup&gt;b**&lt;/sup&gt;</td>
<td>98</td>
</tr>
</tbody>
</table>

Note.  
<sup>a</sup> = Point bi-serial Correlations,  
<sup>b</sup> = chi-square,  
*<sup>p</sup> < 0.05,  
**<sup>p</sup> < 0.01,
Table 5 reports the results for the first research question. According to Table 5 in the second set of columns, only one statistically significant relationship was found between a father engaging in work assignments at home and college entry math proficiency for their adolescent, $r(66) = -.257, p < 0.05$. As fathers’ engaged in less work assignments at home their adolescents were more likely to enroll in a college-level math course.
Table 5

*Father Correlational Bivariate Relationship Analyses for Family Context Variables with Pre-College Coursework and Math Proficiency Variables*

<table>
<thead>
<tr>
<th>Predictor Variables</th>
<th>Pre-College Coursework</th>
<th>N</th>
<th>Math Proficiency</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>PARQ Score</td>
<td>.053&lt;sup&gt;a&lt;/sup&gt;</td>
<td>65</td>
<td>.127&lt;sup&gt;a&lt;/sup&gt;</td>
<td>63</td>
</tr>
<tr>
<td>Spend time</td>
<td>.094&lt;sup&gt;a&lt;/sup&gt;</td>
<td>68</td>
<td>-.035&lt;sup&gt;a&lt;/sup&gt;</td>
<td>66</td>
</tr>
<tr>
<td>Get along</td>
<td>.121&lt;sup&gt;a&lt;/sup&gt;</td>
<td>68</td>
<td>-.008&lt;sup&gt;a&lt;/sup&gt;</td>
<td>68</td>
</tr>
<tr>
<td>Converse about academics</td>
<td>.027</td>
<td>68</td>
<td>.203&lt;sup&gt;a&lt;/sup&gt;</td>
<td>68</td>
</tr>
<tr>
<td>Converse about social life</td>
<td>-.147&lt;sup&gt;a&lt;/sup&gt;</td>
<td>69</td>
<td>-.138</td>
<td>67</td>
</tr>
<tr>
<td>Discuss activities</td>
<td>.066&lt;sup&gt;a&lt;/sup&gt;</td>
<td>67</td>
<td>.134&lt;sup&gt;a&lt;/sup&gt;</td>
<td>65</td>
</tr>
<tr>
<td>Parenting style</td>
<td>1.209</td>
<td>68</td>
<td>2.124&lt;sup&gt;b&lt;/sup&gt;</td>
<td>66</td>
</tr>
<tr>
<td>PI Score</td>
<td>-.032&lt;sup&gt;a&lt;/sup&gt;</td>
<td>70</td>
<td>.006&lt;sup&gt;a&lt;/sup&gt;</td>
<td>68</td>
</tr>
<tr>
<td>Emphasize the importance of math</td>
<td>-.012&lt;sup&gt;a&lt;/sup&gt;</td>
<td>70</td>
<td>.039&lt;sup&gt;a&lt;/sup&gt;</td>
<td>68</td>
</tr>
<tr>
<td>Ask about math classes</td>
<td>-.055&lt;sup&gt;a&lt;/sup&gt;</td>
<td>70</td>
<td>.021&lt;sup&gt;a&lt;/sup&gt;</td>
<td>68</td>
</tr>
<tr>
<td>Ask about topics</td>
<td>-.068&lt;sup&gt;a&lt;/sup&gt;</td>
<td>70</td>
<td>-.109&lt;sup&gt;a&lt;/sup&gt;</td>
<td>68</td>
</tr>
<tr>
<td>Predicator Variables</td>
<td>Pre-college coursework</td>
<td>N</td>
<td>Math Proficiency</td>
<td>N</td>
</tr>
<tr>
<td>---------------------------------------------------</td>
<td>------------------------</td>
<td>-----</td>
<td>------------------</td>
<td>-----</td>
</tr>
<tr>
<td>Ask if you had math homework</td>
<td>.013\textsuperscript{a}</td>
<td>70</td>
<td>.040\textsuperscript{a}</td>
<td>68</td>
</tr>
<tr>
<td>Direct vs. Indirect assistance</td>
<td>.008\textsuperscript{b}</td>
<td>47</td>
<td>.013\textsuperscript{b}</td>
<td>46</td>
</tr>
<tr>
<td>PEC</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Standard vs. Non-Standard Hours</td>
<td>.124\textsuperscript{b}</td>
<td>67</td>
<td>.831\textsuperscript{b}</td>
<td>65</td>
</tr>
<tr>
<td>Monday - Friday vs. non</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Monday- Friday Schedule</td>
<td>.092\textsuperscript{b}</td>
<td>70</td>
<td>.123\textsuperscript{b}</td>
<td>68</td>
</tr>
<tr>
<td>Morning vs. Non Morning shift</td>
<td>.348\textsuperscript{b}</td>
<td>67</td>
<td>.193\textsuperscript{b}</td>
<td>65</td>
</tr>
<tr>
<td>Talk with enthusiasm about job</td>
<td>.203\textsuperscript{a}</td>
<td>65</td>
<td>.065\textsuperscript{a}</td>
<td>63</td>
</tr>
<tr>
<td>Engage in work assignments at home</td>
<td>-.208\textsuperscript{a}</td>
<td>68</td>
<td>-.257\textsuperscript{a*}</td>
<td>66</td>
</tr>
<tr>
<td>Stressed from work</td>
<td>.020\textsuperscript{a}</td>
<td>68</td>
<td>.030\textsuperscript{a}</td>
<td>65</td>
</tr>
<tr>
<td>Advanced math class</td>
<td></td>
<td></td>
<td>10.444\textsuperscript{b*}</td>
<td>68</td>
</tr>
<tr>
<td>Gender</td>
<td>3.938\textsuperscript{a}</td>
<td>70</td>
<td>15.588\textsuperscript{b**}</td>
<td>68</td>
</tr>
</tbody>
</table>

Note. \textsuperscript{a} = Point bi-serial Correlations, \textsuperscript{b} = Chi-square

\textsuperscript{*}p < 0.05, \textsuperscript{**}p < 0.01
Relationship between Parent-Adolescent Relationship Quality, Parental Involvement, Parental Employment Characteristics Measure, and Pre-college Coursework on Math Proficiency

An additional variable is examined from the previous results for both mother and fathers for this research question. The mother results for this research question are listed below. As reported in Table 4, there is a statistically significant association between enrollment in an advanced math class during high school and math proficiency at college entry, \( X^2 (N= 98) = 8.835, p < 0.01, \phi = .300 \). When adolescents enroll in an advanced math class during high school it is related to enrollment in a college-level math class at college entry.

The father results for this research question in table 5 in the second set of columns, indicates a significant association between enrollment in an advanced math class during high school and college math placement, \( X^2 (N =68) = 10.444, p < 0.01, \phi = .321 \). When adolescents enroll in an advanced math class during high school it is related to enrollment in a college-level math class at college entry.

Mediation of Enrollment in an Advanced Math Course

The results for adolescents who lived with a mother, are provided in the first set of columns of Table 3 provide evidence for relationships between the three measures and enrollment in an advanced math class in high school. As reported there, no significant relationships were found between the three measures and enrollment in an advanced math class in high school. However, when a second set of correlational analyses were conducted for individual items of the three measures (PARG, PI, and PEC) in relation to
pre-college coursework, significant correlations were discovered. As shown in table 5, a mother spending time with her adolescent, \( r(98) = .221, p < 0.05 \), and discussing her adolescent's activities, \( r(101) = .246, p < 0.05 \), were related to enrollment in an advanced math class in high school. The more frequent a mother spends time with her adolescent and discusses her adolescent's activities is related to adolescents enrolling in an advanced math class during high school.

Also, two additional bivariate analyses were conducted to determine if gender was associated with enrollment in advanced math course and math proficiency. A significant association was not found between gender and enrollment in an advanced math course. However, a significant association was found between gender and math proficiency, \( X^2(N=98) = 12.048, p < 0.01, \phi = -.351 \), indicating that males were more likely than females to exhibit college-level math proficiency at college entry.

The father results in table 5 indicate there no significant relationships were found between the three measures and the mediation of enrollment in an advanced math class. Even when a second set of correlational analyses were conducted for individual items of the three measures (PARG, PI, & PEC), no significant results were found.

Also, two additional bivariate analyses were conducted to determine if gender was associated with enrollment in an advanced math course and math proficiency. A significant association was not found between gender and enrollment in an advanced math course. However, a significant association was found between gender and math proficiency, \( X^2(N=68) = 15.588, p < 0.01, \phi = -.479 \), indicating that females were less likely than males to enroll in college-level mathematic courses as a freshman.
Relationship of Parental Employment Characteristics Measure on Parent-Adolescent Relationship Quality and Parental Involvement

The results displayed in Table 5 indicate mother’s parental employment characteristics in relation to the parent-adolescent relationship quality and parental involvement Measure. As shown in Table 4, significant relationships were found between the parent-adolescent relationship quality measure and parental employment characteristics measure. A significant relationship exists between parent-adolescent relationship quality and standard work hours, $r (95) = .304, p < 0.01$. A high parental-adolescent relationship quality is related to a mother. In addition, a significant relationship exists between a mother talking with enthusiasm about her job, and parent-adolescent relationship quality, $r (96) = .462, p < 0.01$. When an adolescent reports that his or her mother talked with enthusiasm about her job it increases the perceived parental-adolescent relationship quality. Another significant relationship is a mother's parenting style and working non-standard hours, $X^2(N=94) = 5.311, p < 0.01$, phi = .238. Specifically, a mother is more likely to display an authoritative parenting style when she engages in standard work hours.

As shown in Table 6, there were relationships between the parental employment characteristics and parental involvement measures. A significant relationship exists between parental involvement and the type of shift a mother works, $r (93) = .221, p < 0.05$. Thus, a mother's parental involvement level increases when a mother works a morning shift. In addition, a significant positive relationship exists between parental involvement and a mother who talks with enthusiasm about her job, $r (96) = .237, p <
0.05. As a mother talks with enthusiasm about her job it increases her level parental involvement regarding mathematics during high school.
### Table 6
*Mother Correlational Bivariate Relationships for Parental Employment Characteristics with Parent-Adolescent Relationship Quality and Parental Involvement*

<table>
<thead>
<tr>
<th>Variables</th>
<th>Work Hours</th>
<th>N</th>
<th>Work Schedule</th>
<th>N</th>
<th>Work Shift</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>PARQ</td>
<td>.304a***</td>
<td>95</td>
<td>.183a</td>
<td>93</td>
<td>.290a***</td>
<td>93</td>
</tr>
<tr>
<td>Spend time</td>
<td>.263a**</td>
<td>91</td>
<td>.133a</td>
<td>90</td>
<td>.263a*</td>
<td>90</td>
</tr>
<tr>
<td>Get along</td>
<td>.308a**</td>
<td>94</td>
<td>.218a*</td>
<td>93</td>
<td>.244a*</td>
<td>93</td>
</tr>
<tr>
<td>Converse about academics</td>
<td>.151a</td>
<td>94</td>
<td>.067a</td>
<td>93</td>
<td>.114a</td>
<td>93</td>
</tr>
<tr>
<td>Converse about social life</td>
<td>.198a</td>
<td>93</td>
<td>.147a</td>
<td>92</td>
<td>.247a*</td>
<td>92</td>
</tr>
<tr>
<td>Discuss activities</td>
<td>.184a</td>
<td>93</td>
<td>.146a</td>
<td>92</td>
<td>.266a*</td>
<td>92</td>
</tr>
<tr>
<td>Parenting style</td>
<td>5.764b*</td>
<td>95</td>
<td>3.025b</td>
<td>93</td>
<td>4.626b*</td>
<td>93</td>
</tr>
<tr>
<td>PI Score</td>
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<td>95</td>
<td>.172a</td>
<td>93</td>
<td>.221a*</td>
<td>93</td>
</tr>
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<td>.068a</td>
<td>94</td>
<td>.093a</td>
<td>93</td>
<td>.184a</td>
<td>93</td>
</tr>
<tr>
<td>Ask about math classes</td>
<td>.199a</td>
<td>95</td>
<td>.200a</td>
<td>93</td>
<td>.258a*</td>
<td>93</td>
</tr>
<tr>
<td>Ask about topics</td>
<td>.099a</td>
<td>94</td>
<td>.086a</td>
<td>93</td>
<td>.107a</td>
<td>93</td>
</tr>
<tr>
<td>Ask if you had math homework</td>
<td>.168a</td>
<td>94</td>
<td>.178a</td>
<td>93</td>
<td>.177a</td>
<td>93</td>
</tr>
<tr>
<td>Direct vs. Indirect assistance</td>
<td>.159b</td>
<td>68</td>
<td>.125b</td>
<td>68</td>
<td>2.191b</td>
<td>68</td>
</tr>
<tr>
<td>Variables</td>
<td>Talk with enthusiasm about job</td>
<td>N</td>
<td>Stressed from work</td>
<td>N</td>
<td>Engage in work assignments</td>
<td>N</td>
</tr>
<tr>
<td>---------------------------------</td>
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<td>---</td>
<td>---------------------</td>
<td>---</td>
<td>---------------------------</td>
<td>---</td>
</tr>
<tr>
<td>PARQ score</td>
<td>.462***</td>
<td>96</td>
<td>-.030a</td>
<td>95</td>
<td>-.002a</td>
<td>96</td>
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<tr>
<td>Spend time</td>
<td>.211a*</td>
<td>92</td>
<td>.103a</td>
<td>91</td>
<td>-.044a</td>
<td>92</td>
</tr>
<tr>
<td>Get along</td>
<td>.338a**</td>
<td>95</td>
<td>-.070a</td>
<td>94</td>
<td>.006a</td>
<td>95</td>
</tr>
<tr>
<td>Converse about academics</td>
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<td>95</td>
<td>-.177a</td>
<td>94</td>
<td>.010a</td>
<td>95</td>
</tr>
<tr>
<td>Converse about social life</td>
<td>.443a**</td>
<td>94</td>
<td>-.057a</td>
<td>93</td>
<td>-.019a</td>
<td>94</td>
</tr>
<tr>
<td>Discuss activities</td>
<td>.382a**</td>
<td>94</td>
<td>-.052a</td>
<td>93</td>
<td>-.066a</td>
<td>94</td>
</tr>
<tr>
<td>Parenting style</td>
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<td>96</td>
<td>.039a</td>
<td>95</td>
<td>-.038a</td>
<td>96</td>
</tr>
<tr>
<td>PI Score</td>
<td>.237*</td>
<td>96</td>
<td>-.022a</td>
<td>95</td>
<td>.121a</td>
<td>96</td>
</tr>
<tr>
<td>Emphasize the importance of math</td>
<td>.093a</td>
<td>95</td>
<td>-.056a</td>
<td>94</td>
<td>-.106a</td>
<td>95</td>
</tr>
<tr>
<td>Ask about math classes</td>
<td>.284**</td>
<td>95</td>
<td>.022a</td>
<td>94</td>
<td>-.084a</td>
<td>95</td>
</tr>
<tr>
<td>Ask about topics</td>
<td>.110</td>
<td>95</td>
<td>-.104a</td>
<td>94</td>
<td>-.080a</td>
<td>95</td>
</tr>
<tr>
<td>Ask if you had any homework</td>
<td>.245*</td>
<td>95</td>
<td>.010a</td>
<td>94</td>
<td>-.059a</td>
<td>95</td>
</tr>
<tr>
<td>Direct vs. Indirect Assistance</td>
<td>-.156</td>
<td>71</td>
<td>.141a</td>
<td>69</td>
<td>.009a</td>
<td>69</td>
</tr>
</tbody>
</table>

Note.  

*a* = Point Bi-serial Correlations,  
*b* = Chi-square  
*p < 0.05, **p < 0.01*

Work Hours= Standard vs. Nonstandard Work Hours, Work Schedule = Monday - Friday vs. Non Monday- Friday Schedule,  
Work Shift = Morning Shift vs. Non Morning Shift
Table 7 displays various significant relationships between a father's work-family balance items and parent-adolescent relationship quality and parental involvement. As reported there, an adolescent's perception that his or her father talked with enthusiasm about his job is correlated to a reported high parent-adolescent relationship quality, $r (61) = .513, p < 0.01$, and a high perceived level of parental involvement with his adolescent, $r (65) = .376, p < 0.01$. A significant relationship between an adolescent's perception of a father being stressed from work and conversing with his adolescent about academics emerged from the study, $r (67) = -.336, p < 0.01$, and a perceived level of parental involvement, $r (67) = -.405, p < 0.01$. When fathers were less stressed from work it increased the likelihood of him engaging in conversations about academics and an increased level of parental involvement with their adolescents. Additionally, there was a statistically significant relationship between a father engaging in work assignments and asking if his adolescent had math homework, $r (68) = -.304, p < 0.01$. As fathers engaged in less work assignments at home it increased their likelihood of asking if their adolescent had homework.
Table 7

*Father Correlational Bivariate Relationships for Parental Employment Characteristics with Parent-adolescent Relationship Quality and Parental Involvement*

<table>
<thead>
<tr>
<th>Variables</th>
<th>Work Hours</th>
<th>N</th>
<th>Work Schedule</th>
<th>N</th>
<th>Work Shift</th>
<th>N</th>
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</thead>
<tbody>
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<td>PARQ</td>
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<td>63</td>
<td>-.011&lt;sup&gt;a&lt;/sup&gt;</td>
<td>65</td>
<td>-.029&lt;sup&gt;a&lt;/sup&gt;</td>
<td>63</td>
</tr>
<tr>
<td>Spend time</td>
<td>-.135&lt;sup&gt;a&lt;/sup&gt;</td>
<td>65</td>
<td>.090&lt;sup&gt;a&lt;/sup&gt;</td>
<td>68</td>
<td>.152*</td>
<td>65</td>
</tr>
<tr>
<td>Get along</td>
<td>-.031&lt;sup&gt;a&lt;/sup&gt;</td>
<td>67</td>
<td>.011&lt;sup&gt;a&lt;/sup&gt;</td>
<td>70</td>
<td>.148&lt;sup&gt;a&lt;/sup&gt;</td>
<td>67</td>
</tr>
<tr>
<td>Converse about academics</td>
<td>.002&lt;sup&gt;a&lt;/sup&gt;</td>
<td>67</td>
<td>.031&lt;sup&gt;a&lt;/sup&gt;</td>
<td>70</td>
<td>-.038&lt;sup&gt;a&lt;/sup&gt;</td>
<td>67</td>
</tr>
<tr>
<td>Converse about social life</td>
<td>.176&lt;sup&gt;a&lt;/sup&gt;</td>
<td>67</td>
<td>-.185&lt;sup&gt;a&lt;/sup&gt;</td>
<td>69</td>
<td>-.035&lt;sup&gt;a&lt;/sup&gt;</td>
<td>67</td>
</tr>
<tr>
<td>Discuss activities</td>
<td>-.021&lt;sup&gt;a&lt;/sup&gt;</td>
<td>64</td>
<td>.057&lt;sup&gt;a&lt;/sup&gt;</td>
<td>67</td>
<td>-.078&lt;sup&gt;a&lt;/sup&gt;</td>
<td>64</td>
</tr>
<tr>
<td>Parenting style</td>
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<td>65</td>
<td>.000&lt;sup&gt;b&lt;/sup&gt;</td>
<td>68</td>
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<td>65</td>
</tr>
<tr>
<td>PI Score</td>
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<td>67</td>
<td>.104&lt;sup&gt;a&lt;/sup&gt;</td>
<td>70</td>
<td>-.064&lt;sup&gt;a&lt;/sup&gt;</td>
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<tr>
<td>Emphasize the importance of math</td>
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<td>67</td>
<td>.049&lt;sup&gt;a&lt;/sup&gt;</td>
<td>70</td>
<td>-.090&lt;sup&gt;a&lt;/sup&gt;</td>
<td>67</td>
</tr>
<tr>
<td>Ask about math classes</td>
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<td>67</td>
<td>.100&lt;sup&gt;a&lt;/sup&gt;</td>
<td>70</td>
<td>-.070&lt;sup&gt;a&lt;/sup&gt;</td>
<td>67</td>
</tr>
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<td>Ask about topics</td>
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<td>67</td>
<td>.103&lt;sup&gt;a&lt;/sup&gt;</td>
<td>70</td>
<td>-.010&lt;sup&gt;a&lt;/sup&gt;</td>
<td>67</td>
</tr>
<tr>
<td>Ask if you had homework</td>
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<td>67</td>
<td>.099&lt;sup&gt;a&lt;/sup&gt;</td>
<td>70</td>
<td>-.041&lt;sup&gt;a&lt;/sup&gt;</td>
<td>67</td>
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<tr>
<td>Direct vs. indirect assistance</td>
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<td>45</td>
<td>.009&lt;sup&gt;b&lt;/sup&gt;</td>
<td>47</td>
<td>.503&lt;sup&gt;b&lt;/sup&gt;</td>
<td>45</td>
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<tr>
<td>Variables</td>
<td>Talk with enthusiasm about job</td>
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<td>Stressed from work</td>
<td>N</td>
<td>Engage in work assignments</td>
<td>N</td>
</tr>
<tr>
<td>---------------------------------</td>
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<td>--------------------</td>
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<td>-----</td>
</tr>
<tr>
<td>PARQ score</td>
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<td>61</td>
<td>-.243a</td>
<td>63</td>
<td>.053a</td>
<td>64</td>
</tr>
<tr>
<td>Spend time</td>
<td>.379**</td>
<td>63</td>
<td>-.161a</td>
<td>65</td>
<td>.143a</td>
<td>66</td>
</tr>
<tr>
<td>Get along</td>
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<td>65</td>
<td>-.031a</td>
<td>67</td>
<td>.120a</td>
<td>68</td>
</tr>
<tr>
<td>Converse about academics</td>
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<td>65</td>
<td>-.336a*</td>
<td>67</td>
<td>-.040a</td>
<td>68</td>
</tr>
<tr>
<td>Converse about social life</td>
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<td>65</td>
<td>-.206a</td>
<td>67</td>
<td>.032a</td>
<td>68</td>
</tr>
<tr>
<td>Discuss activities</td>
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<td>-.207a</td>
<td>64</td>
<td>-.022a</td>
<td>65</td>
</tr>
<tr>
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<td>-.118a</td>
<td>65</td>
<td>-.206a</td>
<td>66</td>
</tr>
<tr>
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<td>-.405a**</td>
<td>67</td>
<td>-.200a</td>
<td>68</td>
</tr>
<tr>
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<td>-.330a**</td>
<td>67</td>
<td>-.110a</td>
<td>68</td>
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<tr>
<td>Ask about math classes</td>
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<td>65</td>
<td>-.358a**</td>
<td>67</td>
<td>-.151a</td>
<td>68</td>
</tr>
<tr>
<td>Ask about topics</td>
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<td>65</td>
<td>-.264a**</td>
<td>67</td>
<td>-.075a</td>
<td>68</td>
</tr>
<tr>
<td>Ask if you had any homework</td>
<td>.244a</td>
<td>65</td>
<td>-.393a**</td>
<td>67</td>
<td>-.304a</td>
<td>68</td>
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<tr>
<td>Direct vs. Indirect Assistance</td>
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<td>44</td>
<td>-.037b</td>
<td>45</td>
<td>.261b</td>
<td>45</td>
</tr>
</tbody>
</table>

Note. a = Correlations, b = chi-square

*p < 0.05, **p < 0.01
Figure 2

Family Context Factors that are Related to Math Proficiency at College Entry for First-generation Students who Lived with their Mother During High School
Figure 3

Family Context Factors that are Related to Math Proficiency at College Entry for First-generation Students who Lived with their Father During High School
CHAPTER IV
DISCUSSION

The purpose of this study was to fill the gap in the literature that posits enrollment in advanced math classes in high school is the only factor that influences math proficiency at college entry for first-generation students. This study sought to use a holistic perspective to determine additional factors that influence math proficiency at college entry. A direct correlation path was not found between maternal-adolescent relationship quality, maternal involvement, and maternal employment characteristics with enrollment in an advanced math class or math proficiency at college entry for first-generation students. However, the results provide indirect pathways of factors that influence math proficiency at college entry and enrollment in an advanced math course during high school.

Parent-Adolescent Relationship Quality, Parental Involvement, and Parental Employment Characteristics on Math Proficiency

The first research question examined the relationship between parent-adolescent relationship quality and parental employment characteristics and its relationship with math proficiency at college entry. The present study found only one factor that is related to math proficiency at college entry for adolescents who lived with their mother, which is the adolescent's perception of the mother conversing about academics. This relationship suggests a mother who frequently converses about academics with her adolescent increases the likelihood that the respondent will place into
a college level math course. Previous research has found similar results that support the idea that parent-child communication is associated with academic achievement (Epstein & Sander, 2002; Yonezawa, 2000) and this study suggests that communication specifically about academics is beneficial. Perhaps when parents emphasize and promote educational achievement through communication, adolescents are more receptive and attempt to meet the expectations of the parent.

On the other hand, only one variable related to math proficiency at college entry for adolescents who lived with their father, which is adolescents' perception of father engages rarely or never engages in work assignments at home is related to math proficiency at college entry. This finding supports a previous research study which suggests men in fatherhood are more serious about their work efficiency than non-fathers; however, they tend not to over commit or focus primarily on their career. Therefore, this can suggest that fathers in this study do not over commit (Eggebean & Knoester, 2001) or engage in a negative work-family spillover and do not engage in work assignments at home, thus, allowing time to interact and assist with math proficiency at college entry. A later analysis will create a direct path based on the results from this study.

These results confirm the gender roles for a man and women within a family. A mother’s nurturing qualities in developing a relationship with her adolescent is related to the adolescent’s overall academic outcomes and a father’s employment characteristics relate to math proficiency at college entry. Not only does a father’s employment affect the economic outcomes it also is related to academic achievements, specifically, math proficiency at college entry. On the contrary, even though mothers are engaging in work
outside the home, their nurturing values still dominate in relation to an adolescent’s academic outcomes.

A non-significant, yet meaningful relationship to highlight for both mothers and fathers is that their work hours were not a factor that relates to math proficiency at college entry. Adolescents living in a household with a parent employed working non-standard hours are not doomed and still can achieve math proficiency. In addition, there is no relationship between conversing about academics and a mother's work hours. These two results can be combined together to infer that there is no difference in the frequency of communication about academics for mothers who work standard hours versus non-standard hours. Therefore, a mother's work schedule does not determine the frequency of communication about academics or influence math proficiency. Previous studies have suggested similar results, that there is no relation between maternal employment and academic achievement (Paulson, 1996). The present study is the first that examines specific features of a mother’s and father’s employment situation in relation to adolescents' academic achievement.

No significant relationship was found with the present study between mothers and father’s parental involvement and math proficiency at college entry. This finding was unexpected and it warrants further examination. Given that men are generally more proficient in math and the world socializes men and math, it is shocking that no relationships were found between the level of parental involvement in math and the adolescent math proficiency at college entry. On the contrary, one must suggest that a relationship would not exist between the level of maternal involvement in math and the
adolescent’s math proficiency at college entry, due to the negative relationship between women and math and how the media socializes women to fear or be intimidated by math.

These non-significant relationships were not consistent with previous research, which suggest that parents who emphasize the importance of math increase the student's math achievement (Hong, Yoo, & Wu, 2010). This may be attributed to differences in operational definitions of math achievement. The present study identified math achievement as placement into college-level math as a freshman and previous research identified math achievement based on a score on a standardized test. In addition, the inconsistency of results could be attributed to the small sample size. It could also suggest that mothers or fathers engage in other developmentally appropriate parental involvement tasks with their adolescents in high school that influence math proficiency at college entry, for example, assisting students in managing their homework (Zhan, 2006). Future research could examine this as well as other more developmentally appropriate parental involvement tasks to assist first-generation adolescent students with math.

**Parent-Adolescent Relationship Quality, Parental Involvement, Parental Employment Characteristics Measures, and Pre-College Coursework on Math Proficiency**

In addition to the previous findings that influence math proficiency for adolescents living with a mother or father, enrollment in an advanced math class during high school is related to math proficiency at college entry for adolescent living with a mother or father. This result is consistent with previous research indicating that first-generation students who enroll in an advanced math class or a combination of advanced
math classes in high school achieve greater academic success in college (Adelman, 2006, 1999; Trusty & Niles, 2003). Enrollment in these courses adequately prepares students for college and a lack of preparation can contribute to enrollment in developmental math (National Center for Education Statistics, 2011). Therefore, when first-generation students enroll in at least one advanced math class during high school it increases the likelihood of their placement in college-level math. First-generation students need support from parents, teachers, counselors, and other adult figures to encourage enrollment in an advanced math course or a combination of advanced math classes in high school.

**Mediation of Enrollment in an Advanced Math Course**

The previous results indicate there is an association between enrollment in an advanced math class and math proficiency at college entry. Therefore, the mediation determines what family context factors influence enrollment in an advanced math class, which in turn influences math proficiency. Based on the results of the current study, a mother who frequently spends time with her adolescent and frequently engages in discussions of activities her adolescent is involved in, increases the likelihood of her adolescent's enrollment in an advanced math class. This is consistent with previous research that suggests parent-adolescent interactions are associated with enrollment in an advanced math class in high school (Horn & Nunez, 2000). Parent-adolescent interactions are very critical for first-generation students to enroll in an advanced math course in high school to increase their persistence and graduation rates. According to Adelman (1999), parents with a bachelor’s degree are more likely to be involved in their
adolescent's course selection in high school. However, the results from this study suggest that first-generation students are not doomed and specific parent-adolescent relationship quality tasks such as a mother spending time and discussing her adolescent's activities are correlated to students’ enrollment in an advanced math class in high school. However, the results of this study suggest that only mother’s interactions with their adolescent are related to enrollment in an advanced math class during high school. No significant family context factors for fathers were related to enrollment in an advanced math class during high school. Even though father’s employment characteristics are related to math proficiency at college entry, there are no specific relationships between fathers. It should be noted that the majority of students who reported on their father resided in a two-parent household. This could suggest when an adolescent lives in a household with both parents, a mother generally engages in the majority of significant personal and social interactions which is related to enrollment in an advanced math class during high school. Future research with sample of adolescents residing in father-only households is needed to determine the impact of fathers on college-entry math proficiency.

Additionally, gender was analyzed to determine its association between enrollment in an advanced math class during high school and math proficiency at college entry, separately. A significant association between gender and enrollment in an advanced math class in high school did not emerge from this study. This result is not consistent with a previous National Center for Education Statistics (NCES) study on course-taking between the sexes. This 2005 report showed that females enrolled in more challenging math and sciences courses than males in high school (Shettle et al., 2007).
The discrepancy between the two results could be attributed to the difference in populations. The report did not specify a specific population, whereas the current study is specifically examining the variables of first-generation students. The current results suggest there are no gender disparities in advanced math course taking among first-generation students during high school. On the contrary, there is a gender disparity for math placement at college entry. Females are more likely to be placed in developmental math courses compared to males at college entry. Even though females enroll in more advanced math class than males in high school, research shows there is a gender gap in college-level readiness for males and it is not due to the enrollment in high school math classes (OPPAGA, 2006), which is consistent with this study and previous studies. The gender disparity in math proficiency could be reflective of the gender differences of males more frequently excelling in math and sciences compared to females. Future research should examine the gender disparity of math proficiency at college entry, considering there is no gender disparity in the enrollment in an advanced math class in high school.

Given several limitations of the present study, there are two factors related to pre-college coursework which were approaching significance and important to highlight for adolescents living with their mother during high school. One of these was the parenting styles and enrollment in an advanced math class in high school. Although it did not reach statistical significance, there was a trend in the data suggesting that mothers who displayed an authoritative parenting style towards their adolescent in high school increased the likelihood they would enroll in an advanced math class. If the present study
would have attained a larger sample size, this relationship likely would have reached significance. Authoritative parents are warm, responsive, and approachable (Moore, Guzman, Hair & Garrett, 2004; Simpson, 2001), hence adolescents may feel more at ease to come and talk with their parent about school issues and course selection. Authoritative parents have a high regard for educational achievement.

Another factor which came close to approaching statistical significance is a mother's work shift. Specifically, an association between a mother working a morning shift and enrollment in an advanced math class for an adolescent during high school was approaching statistical significance. In the present sample, working a standard shift was statistically significant which is related to a mother displaying an authoritative parenting style, a mother spending time with her adolescent and a mother discussing her adolescent's activities. Therefore, a mother's work shift plays a major role in the adolescent relationship quality. Previous research suggests maternal employment is not related to academic success; however, the current results indicate that specific employment characteristics, such as the shift a mother works, can influence parent-adolescent interactions, which in turn are associated with an adolescent enrolling in an advanced math class in high school.

**Relationship of Parental Employment Characteristics Measure on Parent-Adolescent Relationship Quality and Parental Involvement**

Mothers and fathers work schedules hours that resemble their adolescent school schedule spend more time together. However, a mother who engages in standard work hours increases the adolescent relationship quality overall and a high level of parental
involvement regarding mathematics in high school. In addition, a mother working standard hours are more likely to engage in more parental involvement with an adolescent’s mathematics courses in high school and display an authoritative parenting style. However, this was not a significant relationship for fathers which suggests, that fathers will engage in parental involvement tasks pertaining to their adolescent’s mathematics courses regardless of their work hours. This could be related to the stereotype that men are more proficient in math than women and they are more likely to discuss mathematics regardless of their shift due to their interest or the socialization of math towards men. Plus, the type of parenting style a father displays is not contingent upon their work hours, considering men are more likely to work non-standard hours. However, parent-adolescent interactions are correlated to standard work hours. A mother's or father's work schedule that resembles their adolescent's school schedule increases the amount of time they can spend together. More specifically, it increases the mother's overall relationship quality with the adolescent and parental involvement with adolescent's mathematics classes during high school. Standard work hours are defined as either a full or part-time morning shift scheduled Monday through Friday. This suggests that a mother's and father's availability play a role in first-generation students' outcomes.

A mother's and father's attitude regarding their employment is related to parent-adolescent interactions. Mother's and father's who talk with enthusiasm about their job increase the overall parent-adolescent relationship quality and level of parental involvement. Overall, regardless of a parent's gender, a parent must be enthusiastic about their job so there is not a negative spillover effect that reduces their involvement and
relationship quality with their adolescent. Previous research has found similar findings; a mother's attitude regarding her employment affects an adolescent's outcome, based on the adolescent's perceived attitude of his or her mother (Paulson, 1996). There are two specific parent adolescent relationship quality variables that should be highlighted for mothers: spending time with their adolescent and engaging in discussions about her adolescent's activities. These variables create a path to describe what family context factors influence math proficiency at college entry.

In addition, the other two work-family balance impacts the father adolescent relationship and involvement, in contrast, to only the mother's attitude toward employment impacts the parent-adolescent interactions. A father that is not stressed about his job has more time to engage in parental involvement tasks because when he comes home, work is no longer an issue. Generally, fathers are employed in more demanding and stressful fields which would limit their parental involvement and decrease their parent-adolescent relationship quality. Specifically if they are stressed from work, then they will not engage in parental involvement tasks. Previous research supports this result by exploring a father's parental responsibilities and concluding it is centered around his employment responsibilities (Wall & Arnold, 2007). A father will not leave work early or not engage in assignments at home in order to spend time or engage in parental involvement activities with his adolescent. Related to this finding is a specific task that fathers engage in less when they have to complete work at home, they reduce the frequency of asking if his adolescent had math homework when he frequently engages in work assignments at home.
Summary

Overall, the results of this study suggest that an interaction of the microsystem, mesosystem, and exosystem simultaneously, does influence math proficiency at college entry. Yet, particular dimensions of the microsystem influence math proficiency at college entry and enrollment in an advanced math class during high school. Specifically, it is important for mothers of first-generation students to engage in mother-adolescent relationship interactions to encourage enrollment in an advanced math course and engage in conversations about academics in general to influence math proficiency. This is very imperative for first-generation students, especially, since a higher percentage of these students are placed into developmental math courses compared to their non-first-generation student counterparts.

A mother's employment characteristics have an impact on the degree to which a mother engages in relationship interactions and school-related involvement with her adolescent. When feasible, mothers should take into consideration work hours and their job satisfaction when applying for and accepting positions. Previous literature has not examined these specific parental employment characteristics and their effects on adolescent academic outcomes. However, the findings of this study suggest the need for employers to revise a mother's work hours to align with adolescent's school hours. Overall, this study contributes to the literature on first-generation students' support from parents in academic preparation for access to higher education, especially since none of the pre-existing literature highlights first-generations students' parents and, particularly, mothers' employment characteristics related to academic outcomes.
When adolescents reside with both parents a mother's interactions appear to more directly influence academic achievement. However, results of the present study suggest that a father's engagement in high quality relationship interactions and parental involvement interactions are reflective of his ability to manage a healthy work-family balance. Therefore, the implications of this study include encouraging fathers to engage in employment opportunities that pertain to their interests and promote job satisfaction, and to exhibit less engagement in work assignments at home. Employers could consider these work-family balance items and create flexibility within the organization to promote a balanced level of work and family commitment.

**Limitations**

The results from this present study did not create a linear pathway of family context variables that influence math proficiency at college entry based on the premise of the theoretical model utilized to guide this study. This may be attributed to various limitations of the study. First, the study consisted of a very small sample size (N = 107), which was further divided into mother (N =102) and father subgroups (N=70) for data analysis. Second, the response rate was very low (12%), however, the completion rate (6%) was even lower. The low response and completion rates were very surprising considering that the database retrieved from RPIE containing about 1500 first-generation students was utilized to recruit students to participate in the study. In addition, three professors confirmed their willingness to assist in distributing the survey via email to their students, which totaled approximately 340 students; however, this method of recruitment included non-first-generation students as well. Third, this study required
students to provide retrospective accounts of their experiences with parents and parents' employment characteristics during high school. Students were asked to recall experiences that occurred collectively in a time span ranging from one to four years ago; therefore, it is possible that accurate accounts were not reported due to the gap in time or that only experiences from the students’ senior year may have been reported. Lastly, only adolescents participated in this study and parents did not report on their involvement or parental employment characteristics. Again, parents could have provided a more accurate account of their parental employment characteristics. Collectively, the limitations stated above may have played a critical role in the failure to obtain the anticipated results based on the premise of the theoretical model.

Directions for Future Research

This study was intended to investigate what family context factors influence math proficiency at college entry. While several study limitations constrained the number of statistically significant results, those findings that did emerge suggest that several directions for future research would increase the number of statistically significant results. Future research could conduct a similar study with a larger sample size, which may be attainable by distributing a paper survey in addition to an on-line survey. Students are more likely to complete a survey administered face-to-face versus distributing a survey on-line. Second, implementing a longitudinal instead of a cross sectional approach may provide more accurate accounts of parental interactions with their adolescents, due to repeated measures of the same variables every year until math proficiency at college entry is obtained. Furthermore, future research should incorporate
parents' and adolescent's accounts of parent-adolescent relationship quality and parental involvement that may yield a more valid perspective on the dynamics of parental involvement and interactions. Finally, it may be meaningful to gain a sample of adolescents who only live with their father, to determine if father’s relationship quality, parental involvement, and employment characteristics influence math proficiency at college entry and enrollment in an advanced math class during high school when a mother does not reside in the household.
APPENDICES
APPENDIX A

PARENT-ADOLESCENT RELATIONSHIP MEASURE
Appendix A

Parent-Adolescent Relationship Measure

Directions: While answering the following questions think back to your high school years. Using the following scale, circle the best answer that reflects the relationship you had with your parent during high school. If only one parent was present during high school answer the questions pertaining to that relationship.

Never = Not at all
Rarely = Less than once a month
Occasionally = Once a month
Sometimes = 2-3 times a month
Frequently = Once a week
Usually = 2-3 a week
All the time = Daily

1. While in high school, how often did you and your mother spend time together?

Never Rarely Occasionally Sometimes Frequently Usually All of the time

1a. While in high school, how often did you and your father spend time together?

Never Rarely Occasionally Sometimes Frequently Usually All of the time

2. While in high school, how often did you and your mother get along?

Never Rarely Occasionally Sometimes Frequently Usually All of the time

2a. While in high school, how often did you and your father get along?

Never Rarely Occasionally Sometimes Frequently Usually All of the time
3. While in high school how often did you and your mother converse about academics?

Never  Rarely  Occasionally  Sometimes  Frequently  Usually  All of the time

3a. While in high school how often did you and your father converse about academics?

Never  Rarely  Occasionally  Sometimes  Frequently  Usually  All of the time

4. While in high school how often did you and your mother converse about your social life?

Never  Rarely  Occasionally  Sometimes  Frequently  Usually  All of the time

4a. While in high school how often did you and your father converse about your social life?

Never  Rarely  Occasionally  Sometimes  Frequently  Usually  All of the time

5. While in high school how often did you and your mother discuss your activities?

Never  Rarely  Occasionally  Sometimes  Frequently  Usually  All of the time

5a. While in high school how often did you and your father discuss your activities?

Never  Rarely  Occasionally  Sometimes  Frequently  Usually  All of the time

6. Overall, how did you perceive the quality of the relationship with your mother in high school?

Excellent  Good  Average  Below Average  Poor

6a. Overall, how did you perceive the quality of the relationship with your father in high school?
Excellent       Good       Average       Below Average       Poor

7. Which of the following best describes the type of parenting your mother

displayed towards you in high school?

   o High parental demands and expectations, disciplines without explanation
     or discussion, and not very responsive to your needs (unwilling to listen
     and discuss issues).
   
o High parental demands and expectations, disciplines with explanation and
     allows discussion, and very responsive to your needs (supportive,
     understanding, and willing to listen).
   
o Low parental demands and expectations, rarely disciplines, but responsive
     to your needs.
   
o Provides the basic necessities, no parental demands, and not responsive to
     your needs.

7a. Which of the following best describes the type of parenting your father

displayed towards you in high school?

   o High parental demands and expectations, disciplines without explanation
     or discussion, and not very responsive to your needs (unwilling to listen
     and discuss issues).
   
o High parental demands and expectations, disciplines with explanation and
     allows discussion, and very responsive to your needs (supportive,
     understanding, and willing to listen).
o  Low parental demands and expectations, rarely disciplines, but responsive to your needs.

o  Provides the basic necessities, no parental demands, and not responsive to your needs.
APPENDIX B
PARENTAL INVOLVEMENT MEASURE
Appendix B

Parental Involvement Measure

Directions: When answering the following questions think back to your years in high school. Using the following scale, circle the best answer that reflects the type of parental involvement your parent displayed during high school. If only one parent was present during high school answer the questions pertaining to that relationship.

Never  = Not at all
Rarely  = Less than once a month
Occasionally = Once a month
Sometimes  = 2-3 times a month
Frequently  = Once a week
Usually  = 2-3 a week
All the time  = Daily

1. How often did your mother emphasize the importance of mathematics in high school?
   Never  Rarely  Occasionally  Sometimes  Frequently  Usually  All of the time

1a. How often did your father emphasize the importance of mathematics in high school?
   Never  Rarely  Occasionally  Sometimes  Frequently  Usually  All of the time

2. How often did your mother ask about your math classes in high school?
   Never  Rarely  Occasionally  Sometimes  Frequently  Usually  All of the time

2a. How often did your father ask about your math classes in high school?
   Never  Rarely  Occasionally  Sometimes  Frequently  Usually  All of the time

3. How often did your mother ask about topics covered in math classes in high school?
   Never  Rarely  Occasionally  Sometimes  Frequently  Usually  All of the time
3a. How often did your father ask about topics covered in math classes in high school?

Never   Rarely   Occasionally   Sometimes   Frequently   Usually   All of the time

4. How often did your mother ask if you had math homework in high school?

Never   Rarely   Occasionally   Sometimes   Frequently   Usually   All of the time

4a. How often did your father ask if you had math homework in high school?

Never   Rarely   Occasionally   Sometimes   Frequently   Usually   All of the time

5. When you needed assistance in math, select all the ways your parent(s) provided assistance in high school.

Mother                          Father

Encouraged me to ask my teacher for help

Arranged tutoring sessions for me

Helped me with math assignments herself

Other__________________________

My mother didn’t provide assistance

Encouraged me to ask my teacher for help

Arranged tutoring sessions for me

Helped me with math assignment himself

Other__________________________

My father didn’t provide assistance
APPENDIX C
PARENTAL EMPLOYMENT CHARACTERISTICS MEASURE
Appendix C

Parental Employment Characteristics Measure

**Directions:** When answering the following questions think back to your years in high school. Circle the answer that best reflects the parent employment characteristics you lived with during high school. When answering the last set of questions use the likert scale listed below. Answer the questions according to the parent(s) you lived with during high school.

Never = Not at all
Rarely = Less than once a month
Occasionally = Once a month
Sometimes = 2-3 times a month
Frequently = Once a week
Usually = 2-3 a week
All the time = Daily

1. While in high school what was your mother’s work status?
   Part-time  Full-time  Changed throughout high school  Not employed

1a. While in high school what was your father’s work status?
   Part-time  Full-time  Changed throughout high school  Not employed

2. While in high school what schedule best reflected the amount of days your mother worked each week?
   Monday - Friday
   Monday - Saturday
   Monday - Sunday
Only weekends

2a. While in high school what schedule best reflected the amount of days your father worked each week?

- Monday - Friday
- Monday - Saturday
- Monday - Sunday
- Only weekends

3. While in high school, what shift did your mother work?

- Morning (Work began at 6 a.m. or later and ended by 6 p.m.)
- Afternoon (Work began at 2 p.m. or later and ended by midnight)
- Night (Work began at 9 p.m. or later and ended by 8 a.m.)
- Rotating (Work hours that changed frequently among morning, afternoon, or night hours)

3a. While in high school, what shift did your father work?

- Morning (Work began at 6 a.m. or later and ended by 6 p.m.)
- Afternoon (Work began at 2 p.m. or later and ended by midnight)
- Night (Work began at 9 p.m. or later and ended by 8 a.m.)
- Rotating (Work hours that changed frequently among morning, afternoon, or night hours)

4. While in high school how often was your mother stressed from work?
Never  Rarely  Occasionally  Sometime  Frequently  Usually  All of the time

4a. While in high school how often was your father stressed from work?

Never  Rarely  Occasionally  Sometime  Frequently  Usually  All of the time

5. While in high school how often did your mother talk with enthusiasm about her job?

Never  Rarely  Occasionally  Sometime  Frequently  Usually  All of the time

5a. While in high school how often did your father talk with enthusiasm about his job?

Never  Rarely  Occasionally  Sometime  Frequently  Usually  All of the time

6. While in high school, how often did your mother engage in work assignments at home?

Never  Rarely  Occasionally  Sometime  Frequently  Usually  All of the time

6a. While in high school, how often did your father engage in work assignments at home?

Never  Rarely  Occasionally  Sometime  Frequently  Usually  All of the time
APPENDIX D
COLLEGE MATHEMATICS MEASURE
Appendix D

College Mathematics Measure

Directions: Circle the best response that reflects your mathematics course enrollment as a freshman at Kent State University. If you cannot remember the name of a class please refer to your schedule on flashline.

1. What math course(s) were you enrolled in during your first semester (Fall ’12)?
   - Pre-Algebra
   - Basic Algebra I
   - Basic Algebra II
   - Basic Algebra III
   - Basic Algebra IV
   - Elementary Probability & Statistics
   - Explorations in modern mathematics
   - Algebra and Trigonometry
   - Trigonometry
   - Modeling algebra
   - Basic math concepts I
   - Basic math concepts II
   - Algebra for calculus
   - Intuitive Calculus
   - Calculus with Pre-Calculus I
   - Calculus with Pre-calculus II
   - Analytic Geometry and Calculus I
   - Calculus for Life Sciences
   - Did not take a math course Fall semester ‘12
   - Met math requires through post-secondary education

2. If you did not enroll in a math course your first semester, please select the math course you are currently enrolled in this semester (Spring ’13)?
   - Pre-Algebra
   - Basic Algebra I
3. Do you feel as though your high school math courses prepared you for the ALEX Placement Exam?

Yes

No

Yes, but I forgot the content because of the span of time between courses and the exam
APPENDIX E
PRE-COLLEGE MATH COURSEWORK MEASURE
Appendix E

Pre-College Mathematics Measure

Directions: When answering the following questions think back to your years in high school. Circle the best answer that reflects the pre-college coursework you enrolled in during eighth grade and high school.

1. Did you take algebra in eighth grade?
   
   Yes  No

2. Was algebra offered at your middle school?
   
   Yes  No

3. What math courses did your high school offer? (Please check all that apply)
   
   ○ Algebra
   ○ Algebra II
   ○ Trigonometry
   ○ Pre-Calculus
   ○ Calculus
   ○ Other__________

4. What math courses did you take in high school? (Please check all that apply)
   
   ○ Algebra
   ○ Algebra II
   ○ Trigonometry
5. Thinking back to each of the mathematics classes you took in eighth grade and/or high school, rate your perception of difficulty for each of the following classes using the scale below.

1- Very Easy   2 - Easy   3- Average   4- Difficult   5- Very Difficult

Algebra______ Algebra II______ Trigonometry______ Pre-Calculus______

Calculus______ Other________
APPENDIX F
DEMOGRAPHIC QUESTIONNAIRE
Appendix F

Demographic Measure

1. Did either one of your parents graduate from college with a bachelor’s degree?
   o Yes
   o No

1a. If yes, please indicate if it was your mother, father, or both.
   o Mother
   o Father
   o Both

2. What is your current age?

3. What is your gender?
   o Male
   o Female

4. What is your race or ethnicity?
   o American Indian or Alaskan Native
   o Hawaiian or other Pacific Islander
   o Asian or Asian American
   o Black or African American
   o White or Caucasian
   o Other (Please specify)__________________

5. While in high school what adult did you live with?
   o Mother/Step-mother
   o Father/Step-father
   o Parents
   o Grandma
   o Grandpa
   o Grandparents
   o Other_________
REFERENCES
REFERENCES


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