GENDER DIFFERENCES IN THE NEED FOR POSTSECONDARY MATHEMATICS REMEDIATION

Scotty G. Houston
The University of Memphis
sghoustn@memphis.edu

Yonghong Jade Xu
The University of Memphis
yxu@memphis.edu

Leigh M. Harrell-Williams
The University of Memphis
lmwllm14@memphis.edu

Abstract
The results of a quantitative analysis about potential factors that could influence the need for postsecondary mathematics remediation in males and females are presented in this article. This paper attempts to describe how these selected factors act differently in explaining differences between male and female students. The Beginning Postsecondary Study 2004/2009 is analyzed using multiple regression models to determine if variables such as family income, ethnicity, high school GPA and highest math course taken in high school are influential in the need for remediation. The data shows that many of the secondary school factors are influential in determining remedial need; also, race and parents' highest level of education are significant predictors in some models.
Keywords: remedial mathematics, NCES data, gender, race

Introduction

In recent years, thoughts about education and advancement have changed in the United States. A postsecondary credential has become a dream and goal of many, not only for self-esteem but also for upward mobility. Many employment opportunities are no longer dependent upon manufacturing and agriculture; positions are moving towards science, education and healthcare (Goyette, 2008; Tierney & Hagedorn, 2002; Barber, 2011).

With this shift, leaders in education and policymakers have questioned whether secondary schools are preparing students for the rigors of a postsecondary education, especially in mathematics. Over 50% of high school graduates are underprepared for college mathematics, including gateway courses such as College Algebra and Introductory Statistics (Ashford, 2011). While much of the discussion about the under-preparedness of students is centered on shortcomings in K-12 education (Jackson, 2012; Darden & Cavendish, 2012; Lleras, 2008), other factors, such as race and gender differences are often found in academic achievement (Spence & Usher, 2007; Chiu & Xihua, 2008; Riegle-Crumb, 2006; Chen, 2016; Attewell, 2006). Additionally, first-generation students and minorities are enrolling in large numbers in higher education institutions (Pike & Kuh, 2005), changing the demographics of college-going students.

In a recent study using a large, nationally representative sample of post-secondary students in the United States, Chen (2016) explored the outcomes of taking remedial courses. This paper seeks to add to the existing literature about student preparedness by examining gender differences in post-secondary students that might explain the need for remedial coursework using the same nationally representative dataset. Specifically, the relative influence of student, family and school-related variables on the number of remedial courses taken was investigated separately for male and female students.

Literature Review

Many of the students entering America's higher education institutions are unprepared for the rigors of advanced mathematics in high school, not to mention college mathematics. Researchers have been searching for answers to why there is a need for remedial education. To understand how to reduce remediation, researchers need some context from which to approach this topic, such as Bronfenbrenner's Ecological Theory (Bronfenbrenner, 1977, 1986). While this theory is often used in child and adolescent development, Arnold, Lu and Armstrong (2012) provide an explanation of its adaptation to the development of an individual from secondary student to college student and the difficulties of becoming college-ready. Using the ecological theory framework, factors influencing the need for remediation are organized by background characteristics of the student and family and secondary school history.

Gender

In recent decades, females have outnumbered males in higher education (Bettinger & Long, 2009; Chen, 2016). However, Walker and Plata (2000) found that enrollment in remedial coursework was based on age and ethnicity, not gender. Further, Houston and Xu (2016) reported that gender was not an influential predictor in the need for math remediation. Several researchers discuss how this relationship between gender and remedial need might not be attributed to innate gender differences but to each gender's belief about mathematics ability (Bandura, 1986; 1997; 2006; Spence & Usher, 2007; Chiu & Xihua, 2008; Stage & Kloosterman, 1995). Specifically, Spencer et al. (1999) used the phrase "stereotype threat" (p. 4) as occurring when women are judged to have weaker math ability than men. Spencer et al. (1999) found that, after controlling for stereotype threat by indicating that there were no gender differences on the test, female performance was higher than in a setting where female students were not presented with this information.

Recently, there has been a push to look at the interaction of race and gender, not the two demographics separately. Bécares and Priest (2015) found in classes of eighth-grade students, many of the academic outcomes differ not only between genders and between races but also between gender/race combinations. For example, Hispanic girls outperformed White boys in reading and the arts, but White boys outperformed Hispanic girls in math and science.

Socioeconomic Status (SES) and Ethnicity

Economic status and standing in society are directly impacted by family income, and many minority students come from low SES households (Olinsky, 2014). Remedial courses are saturated with students from low SES backgrounds (Hagedorn et al, 1999; Fong et al., 2015). Minority students consistently score below White students on nearly every metric from kindergarten through twelfth grade (Kao & Thompson, 2003; Riegle-Crumb, 2006; Chen, 2016). Often, minority groups take less rigorous courses in high school causing less than a quarter of African Americans and Hispanics to be prepared for college-level math (Finn, Gerber & Wang, 2002; Rose & Betts, 2001). Attewell (2006) reported that 61% of African American students took some sort of remediation compared to 35% of White students, and 52% of students from families in the lowest quartile of SES undertook remedial coursework compared to 24% of students in the highest quartile (Attewell, 2006). More recently, Chen (2016) found that income and ethnicity influence remedial course taking. For students attending 2-year colleges, approximately 60%-65% of students from the upper 50% of income needed remedial education, as compared to 71%-76% of students in the lowest 25% and lower middle 25% of income. Similar trends were found for those attending 4-year institutions. A higher percentage of African American and Hispanic students, at both 2- and 4- year institutions, took remedial courses as compared to White students. Ethnicity also influences remedial course completion. African American and Hispanic students tend to complete remedial courses at a lesser rate than non-minority groups (Bahr, 2010; Hagedorn, et al, 1999). Only 12% of African American students had successful remediation compared to 20% of Hispanic Students and 30% of White students (Bahr, 2010).

Parents' Background

A student's overall achievement is greater when parents take an active role in student involvement (Hagedorn et al, 1999; Wang, 2004; Chiu & Xihua, 2008). Hagedorn (1999) reported that parental encouragement to attend college was higher in non-remedial students. Students and families that are more involved with each other have a greater academic motivation (Chiu & Xihua, 2008; Gottfried & Fleming, 1998). For example, according to Chiu and Xihua (2008), children from a two-parent family typically have more educational resources, such as books, and parents are more involved in their child's schooling through parent-teacher interactions.

In addition to income, educational attainment of parents is another factor determining students' SES background. Even though SES cannot be changed in the short term by postsecondary education (Bahr, 2010), parents and their own educational capabilities often shape how a student experiences high school and college. Students from higher SES backgrounds are more likely to have parents with some knowledge of postsecondary education (Bers, 2005). Hagedorn (1999) found that more educated parents tend to lower student remediation and influence college and major selection. Studies by Chen (2005) and Nuñez and Cuccaro-Alamin (1998) state that first-generation students are more likely to enroll in developmental courses. Additional studies (Bodfish, 2000; Bers 2005) found that children of parents with at least a bachelor's degree have a larger set of colleges from which to choose than those without postsecondary education, linking the number of college applications to parental SES. Parents without significant postsecondary experience leave students to seek help from high school guidance counselors and academic coaches to make secondary and postsecondary decisions. Without parental support in the decision-making process, students may not enroll in more advanced coursework during their secondary years. Regarding remedial courses, Houston and Xu (2016) found a significant, albeit slight, positive relationship between parental level of education and the need for remediation. Nuñez and Horn (2000) found a positive relationship between parents' level of education and high school mathematics choice leading students to take more advanced mathematics courses in high school. A positive relationship, in this instance, means parents with higher levels of education tend to lower the need for mathematics remediation, and these parents lead their students to take more advanced coursework.

Secondary School Influences

The strongest predictors of obtaining a bachelor's degree are the quality and intensity of high school coursework (Bailey, Hughes & Karp, 2002; Adelman, 1999). Relatedly, high school GPA and highest level of mathematics taken in high school are both influential in determining the number of remedial courses taken (Houston & Xu, 2016;

Fong et al. 2015). Mathematics courses in high school are arranged according to a hierarchy where Algebra I must be successfully completed before Algebra II and Geometry which should be completed before taking a course such as Trigonometry or Statistics (Adelman, 1999; Riegle-Crumb, 2006). Students unable to take the beginning algebra courses early in high school are unable to take more advanced math courses before leaving high school, which is one of the strongest predictors of whether students need math remediation (Adelman, 1999; Riegle-Crumb, 2006; Houston & Xu, 2016).

The presence of highly qualified teachers in the classroom is the only way of obtaining high levels of coursework. The No Child Left Behind Act of 2001 requires highly qualified teachers in the classroom. Howell (2011) found that better performing students come from classrooms with more highly-educated teachers. Other studies have found more affluent classrooms are staffed with more experienced teachers while student outcomes are often hindered in less affluent classrooms due to new and less experienced teachers (Jackson, 2012; Darden & Cavendish, 2012; Lleras, 2008). Teachers with more experience often move out of urban schools to suburban schools leaving less experienced teachers in urban, high-minority schools (Lleras, 2008).

Placement tests such as the ACT or SAT often determine whether a student must enroll in a remedial course (Bailey, Hughes & Karp, 2002). Many researchers have found that higher scores on these standardized entrance exams lower the need for student remediation (Bettinger & Long, 2009; Chen, 2016), as higher scores on standardized tests are related to completion of more advanced courses.

Present Study

The current study used recent data from the National Center for Education Statistics (NCES) called the Beginning Postsecondary Study (BPS) of 2004/2009 (BPS:04/09) to look at the factors that influence the need for postsecondary remedial mathematics.

Chen (2016) presented a comprehensive analysis of the BPS:04/09 data with relation to remedial course taking, including topics such as earning college-credit courses, transfer rates, early attrition rates and persistence and attainment in college. It focused on how enrolling in remedial courses is influential in attaining certain postsecondary outcomes. Different from Chen's study, this study looks at possible predictors of students' need to take math remediation coursework in college. Many of the same variables are used in both research studies; however, the proposed research examines the impact of each variable separately instead of using the academic preparation composite variable used in Chen (2016), which combined high school GPA, highest math course taken in high school and ACT/SAT scores.

The research questions for this study are:

1. How do the proposed factors function differently in determining remedial math needs of males and females?
2. Of the students needing remediation, which factors impact the number of remedial math courses taken?

Methods

Source of Data

Data for this study comes from the NCES Beginning Postsecondary Students Study (BPS: 04/09) and its 2009 Postsecondary Education Transcript Study (PETS:09) follow-up. Only students who attended secondary school in the fifty states or the District of Columbia were included. The sampling design was a two-stage design in which eligible institutions were selected in the first stage, and eligible students, within eligible responding sample institutions, were selected in the second stage. After the data collection, 16,680 had enough data from the student interview or from other administrative sources to be classified as BPS:04/09 study respondents. For this study, only students from the fifty U.S. states and the District of Columbia who self-identified as White, African American or Hispanic were selected. Additionally, only students claimed by a parent or guardian, students who knew their parents' level of education, and students graduating with a high school diploma from a public or private school in the fifty U.S. states or the District of Columbia were selected. After selecting these students from the dataset, there was a total of approximately 5,300 students, and after applying the weight to the data, there were 1, 296 students remaining. Finally, removal of outliers resulted in a final effective sample size of 1,270 students.

Variables

Several variables that are indicative of past need for remediation have been identified in the NCES data. Descriptive statistics of the variables can be found in Table 1.

Income. NCES breaks this category into four monetary range groupings (such as $0-$30000), in addition to a choice for independent students and an option to skip that question. Only the students responding with one of the four dollar amount categories are included with 43% of households earning less than $60,000 per year. Students claimed as a dependent of their parent or guardian (99.6%) or dependents of another individual (0.4%) are grouped together. Students classified as independent were not included.

Gender. For this collection of students, 58% are female, and 42% are male.

Race. Race/Ethnicity was selected with the three largest categories represented: White, (80%), African American (10%) and Hispanic (10%). There were several other categories included in the NCES study; however, these three races tend to be the most explored in the relevant literature. All other races are excluded from the analysis.

Number of postsecondary institutions applied. Students applied to between one and 20 postsecondary institutions with 92% of students applying to no more than six colleges.

Parents' highest level of education. The maximum of father's education level and mother's education level forms this variable. 20% of respondents have parents that graduated high school but have no postsecondary education while 56% of parents have a bachelor's degree or higher. The remainder had more than a high school education but less than a bachelor's degree.

Type of high school. 88% of students attended a public school, and 12% attended a private school.

Highest level of math completed. 21% of high school students stopped high school math after Algebra II, and 25% worked up to Calculus. NCES separates Algebra II and Algebra II/Trigonometry with the latter containing an additional 20% of students.

Test scores. Chen (2016) used a combination of SAT verbal and mathematics tests as the standardized test scores variable; so, this paper uses the combined score as well. ACT scores were converted to SAT scores by NCES using a concordance table provided by College Board. For this study, values ranged from 420 to 1600 with 60% falling between 420 and 1100.

High school GPA. GPA is measured on a 4.0 scale with "A" equal to 4.0, and 82% of students reported having a 3.0 or higher.

Dependent variable. The number of remedial mathematics courses attempted in the postsecondary institution is the dependent variable. 68% of respondents had no remedial mathematics courses attempted on the transcript. Approximately 32.4% indicated remedial mathematics courses ranging from one to nine with 98% taking four courses or less (including the 68% taking zero courses). This variable does include multiple attempts at the same remedial course by the same student.

Analysis

Due to the multi-stage sampling performed by NCES, sampling weights are required in both descriptive and inferential analyses to ensure validity and generalizability. In the study dataset, NCES provided a raw sampling weight which had a mean much greater than one, so each person's data counted for more than it should have. To obtain correctly weighted statistics, each raw weight was divided by the mean, creating a relative weight for descriptive analysis, per the method described in Thomas and Heck (2001). To account for the design effect, each relative weight was divided by the average design effect associated with the NCES multi-stage cluster sampling to obtain the final weights to make appropriate inferences from the hypothesis tests.

First, an ordinary least squares (OLS) multiple regression model was estimated in SPSS for each gender in the entire sample. The independent variables are entered as a block-entry model to see which set of broadly defined categories exerts more influence on remedial need. The blocks are background demographics first, excluding gender, then secondary school variables in block 2. Race is the only nominal predictor variable that is not dichotomous; thus, dummy coding via the creation of two indicator variables for Hispanic and African American was done with White students as the reference group for both indicator variables.

Secondly, an OLS regression model with all the predictor variables, except gender, was estimated for each of the two genders for only students taking remedial coursework. Unless otherwise noted, statistical significance was set at $\alpha=0.01$ for the models, given the relatively large sample sizes.

Results

Preliminary analyses indicated no issues with multicollinearity, assessed via the Variance Inflation Factor, or independence. There were some issues with heteroscedasticity, or lack of constant variance, among the residuals; unlike the typical "shotgun blast" appearance in the scatterplot of the residuals, there was more of a funnel shape to the plot. To remove the influence of outliers, all observations with a standardized residual greater than three were excluded from the models.

Models for Male Students

The first set of models for male students included all males in the sample. The results of the ANOVA and regression coefficients can be found in Tables 2 and 3. The first block was statistically significant accounting for nearly 7% of the overall variance explained. The dummy variable for African American students compared to White students was significant (B = 0.507, β = 0.167) along with parents' highest level of education (β = -0.140). Block 2 added an additional 13% of explained variance to the model with admissions test scores (β = -0.239) and highest math course taken (β = -0.149) as significant predictors, but the racial differences disappeared from Block 1 to Block 2.

Next, models containing only male students requiring remediation were estimated. Since the sample size in this model was low (N=159), an alpha level of 0.05 was used. Block 2 was statistically significant, and admissions test scores were significant (β = -0.246). Results can be found in Tables 4 and 5.

Models for Female Students

The first model included all females in the sample. Both blocks were found to be statistically significant with results appearing in Tables 6 and 7. Each of the two variables for race, African American students compared to White students (*B* = 0.443, β = 0.147) and Hispanic students compared to White students (*B* = 0.435, β = 0.144), along with parents' level of education (β = -0.129) and number of applications (β = -0.154) were significant in Block 1 with 9% of the variance explained. Admissions test scores (β = -0.268), highest math taken (β = -0.151), GPA (β = -0.111) and the variable for Hispanic students compared to White students (*B*= 0.259, β = 0.086) were significant in Block 2, accounting for an additional 15% of explained variance. Racial differences related to African American students disappeared with the introduction of Block 2 variables.

The model containing only females requiring remedial math courses was estimated next. Both blocks were statistically significant. Tables 8 and 9 display the results showing that only admissions test scores were significant in Block 2 (β = -0.236).

Summary of Results from all Models

In Block 1 for the group containing all males and the group containing all females, the variables of African American students compared to White students and parents' highest level of education were significant; however, t-tests revealed that the magnitude of difference was the same for both groups. This means, for example, though the specified indicator variable for race was significant for the two groups (all males and all females), the difference between White males and African American males is statistically the same as the difference between White females and African American females. Likewise, in Block 2 for the same groups, admissions test scores were significant for both groups, but the magnitude of difference was the same for both groups.

Among the two groups requiring remediation test scores were again significant, but t-tests again showed that the magnitude of difference was the same for all comparisons: all males to all males needing remediation, all females to all females needing remediation, all males to all females needing remediation, all females to all males needing remediation and all males needing remediation to all females needing remediation.

Discussion

The primary purpose of this study was to determine if potential factors as selected from the literature were influential in determining the number of remedial mathematics courses a student had to take upon entry to a postsecondary institution for both male and female students. Each of the multiple regression models was "blocked" by first adding the background characteristics and adding secondary school influences in the second block. The outcome variable in all situations was the number of remedial mathematics courses a student took. This discussion section will look at both blocks across the models.

Background Characteristics

Minority students have consistently enrolled in remedial mathematics courses in greater numbers than their non-minority peers (Bettinger & Long, 2005; Crisp & Delgado, 2014). The conclusions presented here are consistent with these previous results. For male students, African American students were found to have a higher mean number of remedial math courses than White students. Looking at the unstandardized coefficient, African American students take 0.507 more remedial math courses, on average, when compared to White students, when holding all other variables constant. For females, both African American and Hispanic students enrolled in more remedial math courses than White students. For African American and Hispanic female students, when compared to White students, the number of remedial math courses taken is 0.443 and 0.435 higher on average, respectively. Thus, it appears that African American males take more remedial math courses than African American females which take more than Hispanic females. In these analyses, there was no significant difference between the mean number of remedial mathematics courses taken between Hispanic males and White males. These results come from the introduction of Block 1 variables. Only for all females in the group was the Hispanic variable significant in Block 2. These racial differences likely disappeared after secondary school influences were added because the variation explained by racial differences in Block 1 is now being explained by the variables associated with secondary school in Block 2. As previous research also found, SES was not statistically significant in any of the models in this study.

For the model containing all male students and the model containing all females, parents' education is significant when only looking at background characteristics. This means more highly educated parents tends to result in students taking a reduced amount of remedial math courses. For all females in the sample, the number of applications was significant implying that, as a proxy for family education level or SES, students applying to more institutions had lower remedial mathematics need; however, it was no longer significant after the introduction of Block 2 variables.

Secondary School Characteristics

Many studies claim that secondary school characteristics influence remedial need (Adelman, 1999; Riegle-Crumb, 2006; Houston & Xu, 2016; Bailey, Hughes & Karp, 2002). As can be seen from the regression results, the significant predictors for females were the secondary school characteristics of admissions test scores, highest mathematics course taken in high school and high school GPA. For males the influential variables were admissions test scores and highest math course taken. These variables are significant from the addition of Block 2. In each model, the variables have a negative influence on the number of remedial math courses taken, meaning that higher admissions test scores, more advanced math courses, and higher GPAs cause students to enroll in fewer remedial mathematics courses. Often, postsecondary institutions use test scores to place students in remedial courses (Bailey, Hughes & Karp, 2002), which supports why admissions test scores were significant in all models. The time at which a student takes the standardized test is potentially correlated with the highest level of math taken up to that point. The score will likely be different if the student takes the ACT or SAT after just Algebra I and Geometry or after Algebra I, Geometry and Algebra II, for example. For this study, the Pearson correlation between highest math course taken and test scores for all students in the sample was 0.505 representing a moderate, positive relationship. Whether a student attended public school or private school was not statistically significant in any of the models in this study.

Conclusion

Remedial mathematics education is a major concern among educators and policymakers, and postsecondary institutions are trying to adjust to this changing climate (Hagedorn et al., 1999). Four regression models in total were run on this dataset, and one common theme among the models was the influence of secondary school variables, particularly highest math course taken in high school, standardized test scores used in the admissions process (e.g., ACT and SAT) and high school grade point average. This is consistent with the literature (Bailey, Hughes and Karp, 2002; Adelman, 1999; Houston & Xu, 2016; Fong et al. 2015). In the models for all males and all females, the secondary school influences accounted for roughly 15% of the explained variance in remedial math courses taken in postsecondary school. The background characteristics of race and parents' level of education was influential for multiple models. In general, minority students took more remedial math courses than non-minority students, and having more educated parents is associated with a lower need for remediation. These results are consistent with the literature (Bettinger & Long, 2005; Crisp & Delgado, 2014; Houston & Xu, 2016).

Remediation has been a key component of postsecondary institutions for several decades. Developmental courses allow students to rise to a level equal to their non-developmental counterparts and complete a postsecondary credential, even if it takes longer. Often, students and finances become exhausted by taking remedial courses, which are regularly not for credit or transferable to a four-year institution. This can cause students to drop out at a time when postsecondary degrees and certificates are of great importance, as up to 45% of jobs require some college or technical school degree (Porchea et al., 2010). The importance is even greater today.

Limitations

Although these analyses used a national dataset, there are some limitations to the studies. The data are only as accurate as the time at which they were collected. The

Beginning Postsecondary Study and transcript follow-up are already outdated as material was collected starting over a decade ago. Remedial education is a field in constant flux, and the presentation method of developmental coursework has changed over the past ten years. Most remedial coursework prior to and during the collection of this data was developmental coursework followed by college-level courses. At a limited number of postsecondary institutions over the past several years, this model has been, or is in the process of being, phased out. The newer presentation method consists of developmental coursework taken as a co-requisite alongside a college-level course. It allows students to satisfy remedial requirements concurrently with college-level, for-credit courses, rather than spending time taking only developmental courses that typically do not count for college credit.

Two of the underlying assumptions of the multiple regression technique are homoscedasticity, or constant variance, and normality of the residuals. In the preliminary analyses for each regression model, residual-based outliers were removed from the analyses to improve the issues with heteroscedasticity. The issue with normality was unable to be corrected. Although multiple regression is a very robust technique, some of the power behind the regression models may be lowered due to this non-normality issue particularly in the models with a small sample size meaning the sample statistics presented could have a level of bias in them.

For Further Research

In these models, the adjusted R^2 values were rather low (upwards of 20%-25%) with most of this value coming from secondary school influences. One area of study that could be beneficial is to determine if another group of variables (e. g. employment of students, career goals, etc.) provided by the BPS:04/09 report is more influential for this sample of students.

As stated above, the nature of developmental education is changing. These studies looked at the previous implementation methods of remedial coursework. One future study could look at how the new co-requisite method differs from the previous method of taking remedial courses before college-level courses. It may take several years to get this data as this new model is only available in a limited number of postsecondary institutions.

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Table 1

Descriptive Statistics for Variables of Interest

Group		Number of Remedial Courses Taken	Gender	African American	Hispanic	Parents' Income in 2005-2006	Parents' Education	High School GPA	Highest Math Taken	High School Type Attended	Number of Apps	Test Scores
	N	Mean		%	%	Mean	Mean	Mean	Mean	%	Mean	Mean
All Students	1270	0.50 (0.90)	42% (Male)	10.5%	9.3%	2.75 (1.04)	5.87 (2.47)	6.20 (0.99)	2.48 (1.23)	87.6% (Public)	3.27 (2.39)	1051.89 (190.92)
Males	533	0.42 (0.80)		7.5%	10.1%	2.84 (1.04)	6.07 (2.42)	6.08 (1.05)	2.57 (1.24)	87.4% (Public)	3.17 (2.38)	1077.70 (188.76)
Males Needing Remediation	159	1.70 (1.05)		12.6%	11.3%	2.64 (1.05)	5.31 (2.37)	5.66 (1.12)	1.88 (1.19)	91.2% (Public)	2.69 (2.09)	965.12 (172.42)
Females	733	0.54 (0.93)		10.6%	10.5%	2.68 (1.03)	5.72 (2.49)	6.29 (0.93)	2.41 (1.21)	87.9% (Public)	3.35 (2.40)	1034.13 (190.33)
Females Needing Remediation	253	1.85 (1.18)		16.6%	16.2%	2.52 (1.06)	5.10 (2.49)	5.85 (1.12)	1.81 (1.14)	90.5% (Public)	2.84 (2.09)	910.31 (166.69)

Note 1: Standard deviations given in parentheses
Note 2: Categories for Parents' Income: 1=Under $30,000, 2=$30,000-$59,999, 3= $60,000-$89,999, 4= $90,000 and above
Note 3: HS GPA Categories: 1= 0.5-0.9, 2= 1.0-1.4, 3= 1.5-1.9, 4= 2.0-2.4, 5= 2.5-2.9, 6= 3.0.-3.4, 7= 3.5-4.0
Note 4: Highest Math Taken Categories: 0= None of These, 1=Algebra II, 2= Algebra II/Trigonometry, 3= Pre-calculus, 4=Calculus
Note 5: The number of males plus the number of females does not equal 1270 because additional outliers were removed from each model.

Table 2

Summary of Hierarchical Regression Analysis for Males from the Entire Sample (N=533)

	Model 1				Model 2			
Variable	*B*	SE *B*	β	t	*B*	SE *B*	β	t
Parents' Education	-0.046	0.015	-0.140*	-3.11	-0.019	0.014	-0.058	-1.32
Number of Applications	-0.034	0.014	-0.100	-2.35	-0.012	0.014	-0.034	-0.84
Income of Parents	-0.02	0.034	-0.027	-0.580	0.005	0.033	0.007	0.16
African American/White	0.507	0.132	0.167*	3.85	0.249	0.127	0.082	1.96
Hispanic/White	0.004	0.115	-0.001	-0.032	-0.102	0.108	-0.039	-0.95
HS GPA					-0.074	0.034	-0.097	-2.19
HS Highest Math					-0.096	0.030	-0.149*	-3.24
HS Type					-0.034	0.096	-0.014	-0.35
Test Scores					-0.001	0.000	-0.239*	-4.66
Model *F* Test		7.503*				14.094*		
R^2		0.066				0.195		
Change in R^2		N/A				0.129		
F Test for Change in R^2		N/A				20.915*		

Note: Race/Ethnicity was represented as two dummy variables with White students as the reference group. The number of remedial mathematics courses taken is the outcome variable. * indicates $p < 0.01$

Table 3

Summary of ANOVA Table for Models of All Males in the Sample

Block	Source of Variation	Sum of Squares	Degrees of Freedom	Mean Square	F	P-Value
1	Regression	22.394	5	4.479	7.503	0.000
	Residual	314.539	527	0.597		
	Total	336.933	532			
2	Regression	65.773	9	7.308	14.094	0.000
	Residual	271.060	523	0.519		
	Total	336.933	532			

Table 4

Summary of Hierarchical Regression Analysis for Males Needing Remediation (N=159)

	Model 1				Model 2			
Variable	*B*	SE *B*	β	t	*B*	SE *B*	β	t
Parents' Education	-0.013	0.038	-0.029	-0.34	0.003	0.038	0.008	0.09
Number of Applications	-0.006	0.041	-0.012	-0.14	0.012	0.040	0.025	0.31
Income of Parents	-0.038	0.088	-0.038	-0.43	-0.011	0.087	-0.011	-0.13
African American/White	0.475	0.265	0.150	1.79	0.190	0.271	0.060	0.70
Hispanic/White	0.138	0.283	0.042	0.488	0.058	0.280	0.018	0.21
HS GPA					-0.072	0.078	-0.076	-0.93
HS Highest Math					-0.046	0.072	-0.053	-0.64
HS Type					-0.044	0.285	-0.012	-0.16
Test Scores					-0.001	0.001	-0.246*	-2.73
Model *F* Test		0.898				1.955*		
R^2		0.028				0.105		
Change in R^2		N/A				0.077		
F Test for Change in R^2		N/A				3.210*		

Note: Race/Ethnicity was represented as two dummy variables with White students as the reference group.
The number of remedial mathematics courses taken is the outcome variable. * indicates $p < 0.05$

Table 5

Summary of ANOVA Table for Models of All Males Needing Remediation in the Sample

Block	Source of Variation	Sum of Squares	Degrees of Freedom	Mean Square	F	P-Value
1	Regression	4.952	5	0.990	0.898	0.484
	Residual	169.003	153	1.103		
	Total	173.954	158			
2	Regression	18.339	9	2.038	1.955	0.048
	Residual	155.616	149	1.042		
	Total	173.954	158			

Table 6

Summary of Hierarchical Regression Analysis for Females from the Entire Sample (N=733)

	Model 1				Model 2			
Variable	*B*	SE *B*	β	t	*B*	SE *B*	β	t
Parents' Education	-0.048	0.014	-0.129*	-3.37	-0.010	0.014	-0.027	-0.73
Number of Applications	-0.059	0.014	-0.154*	-4.26	-0.030	0.013	-0.077	-2.27
Income of Parents	-0.015	0.034	-0.017	-0.44	0.020	0.032	0.022	0.62
African American/White	0.443	0.110	0.147*	4.03	0.105	0.106	0.035	0.99
Hispanic/White	0.435	0.112	0.144*	3.90	0.259	0.104	0.086*	2.49
HS GPA					-0.111	0.039	-0.111*	-2.87
HS Highest Math					-0.115	0.030	-0.151*	-3.88
HS Type					-0.028	0.093	-0.010	-0.30
Test Scores					-0.001	0.000	-0.268*	-5.98
Model *F* Test		15.111*				26.043*		
R^2		0.094				0.245		
Change in R^2		N/A				0.151		
F Test for Change in R^2		N/A				36.066*		

Note: Race/Ethnicity was represented as two dummy variables with White students as the reference group. The number of remedial mathematics courses taken is the outcome variable. *indicates $p < 0.01$

Table 7

Summary of ANOVA Table for Models of All Females in the Sample

Block	Source of Variation	Sum of Squares	Degrees of Freedom	Mean Square	F	P-Value
1	Regression	59.240	5	11.848	15.111	0.000
	Residual	570.383	727	0.784		
	Total	629.623	732			
2	Regression	154.071	9	17.119	26.043	0.000
	Residual	475.552	723	0.657		
	Total	629.623	732			

Table 8

Summary of Hierarchical Regression Analysis for Females Needing Remediation (N=253)

	Model 1				Model 2			
Variable	*B*	SE *B*	β	t	*B*	SE *B*	β	t
Parents' Education	-0.027	0.031	-0.056	-0.87	-0.006	0.030	-0.013	-0.20
Number of Applications	-0.086	0.035	-0.153	-2.45	-0.066	0.034	-0.118	-1.93
Income of Parents	-0.128	0.075	-0.115	-1.69	-0.092	0.073	-0.083	-1.26
African American/White	0.357	0.208	0.113	1.71	0.081	0.211	0.025	0.38
Hispanic/White	0.339	0.214	0.106	1.58	0.205	0.211	0.064	0.97
HS GPA					-0.010	0.071	-0.010	-0.15
HS Highest Math					-0.142	0.067	-0.138	-2.11
HS Type					0.034	0.242	0.008	0.14
Test Scores					-0.002	0.001	-0.236*	-3.21
Model *F* Test		3.851*				5.015*		
R^2		0.072				0.157		
Change in R^2		N/A				0.085		
F for Change in R^2		N/A				6.074*		

Note: Race/Ethnicity was represented as two dummy variables with White students as the reference group. The number of remedial mathematics courses taken is the outcome variable. * indicates $p < 0.01$

Table 9

Summary of ANOVA Table for Models of All Females Needing Remediation in the Sample

Block	Source of Variation	Sum of Squares	Degrees of Freedom	Mean Square	F	P-Value
1	Regression	25.244	5	5.049	3.851	0.002
	Residual	323.212	247	1.311		
	Total	348.456	252			
2	Regression	54.673	9	6.075	5.015	0.000
	Residual	293.783	243	1.211		
	Total	348.456	252			