

ALL KIDS SHOULD BE COLLEGE-READY: EXAMINING THE PREDICTIVE VALUE OF
HIGH SCHOOL CORE COURSEWORK ON REMEDIAL ENROLLMENT AT
COMMUNITY COLLEGE

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ABSTRACT

This thesis examines the core high school coursework of students who participated in the Educational Longitudinal Survey of 2002 (ELS:2002) to examine the predictive value of core high school courses on placement into remedial coursework at community college in order to surmise which course(s) provides students with the necessary human capital to place into credit-bearing, college-level courses as a first year community college student. Human capital is defined as the skills and knowledge a person possesses to which society accords value; in this case, the skills and knowledge to which community colleges accord the value of “college-level.” The alternative to college-level courses is placement into remedial coursework, which is below college-level, non-credit bearing coursework into which students are assigned through the use of criterion-referenced college placement tests like COMPASS or ACCUPLACER. It was determined that a student’s highest mathematics coursework in high school had the greatest predictive value on whether they placed into remedial coursework at community college; the higher the math coursework, the lower the odds that a student required remediation *of any kind*. The number of AP/IB courses a student took also significantly impacted the likelihood of placement. After identifying the core courses that are the best predictors of placement into college-level coursework, this thesis asked whether the acquisition of the determined necessary human capital varied by students’ race, ethnicity, sex, or socioeconomic status (SES); African American males were determined to be the least likely racial/ethnic group to have been exposed to a math course above Algebra II in high school. For every unit increase in SES, students were more likely to have AP/IB coursework; they also had higher odds of taking a math course above Algebra II.

DEDICATION

I would like to thank and dedicate this thesis to my parents, Dick and Judy Salentine, and my husband, Robert Rogan, for their love and support throughout my undergraduate and graduate career. I would also like to dedicate this thesis in memory of my maternal grandmother, Jean Requa, a high school teacher who received her undergraduate and graduate degrees while raising a family of six children; she was an inspiration to many, and the decisions that I make in my research and my academic career will always be influenced by the emphasis that she placed on education.

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INTRODUCTION

Students who place into and enroll in remedial¹ courses in large numbers at community colleges each year create an enormous financial burden for colleges and limit colleges' ability to focus on baccalaureate transfer (Perin 2006). Students who require remedial coursework are not considered to be college-ready; they do not have the knowledge and skills to take college-level coursework and must be taught those skills prior to beginning the sequence of credit-bearing coursework necessary for their degree. The total cost of remedial education in the United States as of 2004 was about one billion annually (Kolajo 2004) and more recently between \$1.9 and \$2.3 billion dollars (Adams 2010; Bailey 2009) as more than half of the nation's community college students enroll in at least one remedial-level course during their tenure (Bailey, Jeong & Cho 2009); some place that number at 60% (Bailey 2008) and the latest research from the National Center for Public Policy and Higher Education & Southern Regional Education Board puts that number at 75% (SREB 2010). Since community colleges have an open-door policy, providing remedial courses is necessary, but the number of incoming students who have just graduated from high school that place into these courses raises questions as to why such extensive remediation is necessary, and what can be done to prevent the need for such courses.

As emphasized in William Julius Wilson's (1996) *When Work Disappears: The World of the New Urban Poor*, changes in the United States' economy, including the recent shifts toward a more technologically driven economy, have greatly impacted the type of training that workers require. This shift disproportionately affects those populations who traditionally occupied unskilled or low-skilled positions. To quote Wilson,

Finally, the wage and employment gap between skilled and unskilled workers is growing partly because education and training are considered more important than ever

in the new global economy. At the same time that changes in technology are producing new jobs, they are making many others obsolete... The shift in demand has been especially devastating for those low-skilled workers whose incorporation into the mainstream economy has been marginal or recent. Even before the economic restructuring of the nation's economy, low-skilled African-Americans were at the end of the employment queue" (Wilson 1996: 28-29).

More often than not, one must now have some sort of postsecondary education in order to be eligible for more desirable jobs; Wilson points out that as our economy has transitioned away from a production-based one, the need for unskilled labor has decreased. Those from low socioeconomic (SES) backgrounds and minorities, who traditionally found themselves part of the unskilled and low-skilled labor force, are pursuing postsecondary degrees at increased rates, including technical degrees as well as Bachelor's degrees and above.

Community colleges play a vital role in providing access to higher degrees through transfer programs for minority and low SES students; more than half of all African-Americans and Hispanics who enroll in postsecondary education attend community college (Bragg 2001). Many minority students choose to attend community colleges because of their open door policy, low costs, and articulation agreements with local four-year public universities (Furchtgott-Roth et al. 2009). Open door policies mandate the acceptance of any student who is eligible to attend; eligibility typically depends on whether the student is an adult and can pay for or find financing for their educational fees, which are much lower than the fees of four-year institutions. Articulation agreements between community colleges and four-year schools usually dictate that if a student completes a two-year college transfer degree and maintains the required grade point average (GPA) they are guaranteed acceptance into the four-year institution as a transfer student.

One major hurdle to completing a transfer or technical degree for community college students, particularly for African-American and Hispanic students, is taking and passing a

college placement test, which all community colleges use to determine the reading, writing, and math comprehension of entering students. Students who place into remedial coursework experience a significantly lower likelihood of degree completion (Brown & Niemi 2007), in part because remediation must be completed sequentially prior to beginning credit-bearing coursework and is time-consuming, costs money, and does not count toward degree completion.

While much of the research on remedial education at community college is focused on improving remedial courses; discussing the misalignment of high school and community college; demonstrating the prevalence of enrollment in remedial coursework; or, more recently, on examining the accuracy of placement tests in predicting course outcomes (Hughes & Clayton 2011), little has been done to determine what best predicts placement out of remedial coursework². Roth et al.'s (2000) piece is one of the works that has examined the link between high school coursework and successful placement into credit-bearing, non-remedial coursework. An interesting finding of Roth et al.'s work "Effect of High School Course-Taking and Grades on Passing a College Placement Test" was that *the race differences in pass rates on Florida's math college placement test (CPT) disappeared for students who had taken advanced math in high school, primarily Algebra 2 or above.*

This finding raises important questions about the ameliorative effects of high school course-taking on race differences in performance in a postsecondary setting like community college, where minority students are disproportionately located in non-credit bearing remedial courses. Whether or not every student should attend college or university is open to debate. However, to be equitable as a society there should be equality of opportunity; to wit, identifying coursework that supplies all students with the necessary human capital to be successful in a college setting is necessary to inform future policy. This thesis will attempt to replicate Roth et

al.'s work by using the National Center for Education Statistics's Education Longitudinal Survey 2002-2006 data to look at the predictive value of students' high school course-taking on remedial placement as first year students at a community college. It should be emphasized that it is vital that public sociologists take their research outside of academia. As the former President of the American Sociological Association, Michael Burawoy (2004:1) stated, "Public sociology aims to enrich public debate about moral and political issues by infusing them with sociological theory and research." Therefore, in addition to the analysis included in this thesis, steps will be taken to disseminate its findings to the appropriate publics in hopes of informing future policy decisions.

LITERATURE REVIEW

Why Community Colleges?

There are a host of reasons to focus on community colleges rather than universities when examining the issue of remedial coursework; two of the primary reasons are: (1) the differences in number of students who require remediation and (2) the population the community colleges serve. First, as discussed above, community colleges have "open door policies" which require them to allow anyone who meets the basic requirements to attend. "...the nation's 1,200 community colleges enroll 11.7 million students, nearly half of all U.S. undergraduates" (Pew 2009 p. 6). As noted, 60% or more of these 11.7 million undergraduates at community colleges require some remediation (Parsad & Lewis 2003; Bailey 2008; SREB 2010); at universities only about 25% of students require any remediation (Greene 2008). The burden of remedial courses weakens the colleges' ability to provide strong transfer programs because enrollment in remedial

education lessens the likelihood of completing a transfer program, or any program (Brown & Niemi 2007; Greene 2008).

A second reason for focusing on community colleges rather than universities is that community colleges offer a wider range of services, including technical degrees for students who choose to pursue them. In support of their college transfer programs, community colleges often have “articulation agreements” with nearby universities, which promise that students who complete transfer programs and maintain a certain GPA are automatically accepted into the university as juniors after completing their Associate’s degree, should they wish to attend. This allows minorities and non-traditional students the opportunity to receive a bachelor’s degree. In other words, community colleges serve half of all undergraduates, 60% or more of whom require remediation and community colleges cannot turn these students away because, on the one hand, they both are required to allow entry and, on the other hand, they are the last line of opportunity for economic mobility for our society’s more vulnerable academic populations.

Finally, as discussed above, annual costs of remedial enrollment are estimated to be between \$1.9 and \$2.3 billion dollars a year for community colleges whereas universities spend about \$500 million a year (Bailey 2009). These are not the only costs of remedial education; in addition to the financial costs, students suffer the loss of time and opportunities, including the opportunity to work full-time. Recent studies put total lost earnings and tax revenues of community college students at around \$2.3 billion annually; since only 17% of students who enroll in a remedial course get their bachelor’s within eight years, enrollment in remedial education reduces a student’s earning potential (Greene 2008). Combining the literal cost of remediation and the cost to society in lost earnings and tax revenues, the annual costs of remediation at community colleges can then be placed between \$4.2 and \$4.6 billion dollars

(Bailey 2009; Greene 2008) without accounting for students' lost time and non-economic opportunities. It is important to make the connection that individuals and society as a whole invest in education and expect to see returns on that investment in the form of economic benefits. When expenditures on remedial courses - what should be secondary-level education – are so great, and the likelihood of degree attainment for those enrolled in remedial coursework is significantly reduced³, it is unclear whether we will see the economic returns on that investment.

Misalignment between High School & Community College

Although around 70% of our nation's students receive a high school diploma, only about 50% of high school graduates have what are considered "college-ready" skills; over half of students enrolled in remedial education are under the age of 24 (Greene 2008). Although requirements vary by state jurisdiction, in all cases these students must have received a proficient score on their state's standardized exams to advance in grade or to graduate from high school. While one would assume that receiving a proficient score on standardized tests in high school is an indicator of college readiness, as the data on remediation demonstrate, this is not the case. In fact, "State assessment directors rightly point out that their tests were never designed to measure college readiness" (Conley 2003:5). It is also important to note that not all high school diplomas have the same requirements; requirements for high school diplomas vary by state, by district, by school and by track. For example, it is possible for students in North Carolina's "Career Prep" course of study to have Algebra I as their highest math where students in the "College/University Prep" course of study are expected to take Algebra I, Algebra II, Geometry as well as a higher math (Public Schools of North Carolina 2010). However, although states vary in their graduation requirements, they are consistent in that a majority of states' high school assessment exams do not measure college-readiness (Conley 2003).

Differences in placement in remedial math versus remedial reading or writing may be due in part, therefore, to what are exaggerated differences in the mathematics-related expectations in high school and college. There is, to be sure, some overlap between the requirements of high school and college with regard to reading and writing skills but there is a great deal of disparity between high school and college math requirements (Brown & Niemi 2007; Brown & Conley 2007; Conley 2003). As a result of the misalignment of expectations, there is consensus that research needs to be conducted that indicates to educators, students, parents and policy makers which classes in high school prepare students for college.

In much the same way as the University of California and California State University systems have prepared a list of course requirements for admission eligibility, community colleges could outline the expected levels of preparation for students to undertake college credit-bearing coursework and how that relates to the courses they need to take in high school. While creating such a set of criteria would require consistency across the community college campuses and would be a challenging undertaking, merely establishing such expectations is not enough. This information would then need to be communicated to students, parents, high school counselors, and high school district curriculum personnel on a consistent and ongoing basis” (Brown & Niemi 2007:27, emphasis supplied).

The underlined passage above highlights Brown & Niemi’s recommendation as related to this study, which aims to replicate previous research, in the hope of determining what courses a student must take in high school in order to increase the likelihood of students’ placement into college-level, credit-bearing coursework at community college.

As high schools are not testing to prepare students for college, one of the more obvious reasons for high enrollment in remedial coursework is the misalignment of high school expectations with those of the community college – the skills and knowledge to which high schools accord value are different from those that the community college system values. Beyond differences in expectations, the type of tests that are used for placement at community colleges is

a different type of test than what is used at the high school level. Community colleges use what are called criterion-referenced tests (CRTs) such as COMPASS or ACCUPLACER⁴ that compare students with a specific criterion or level of mastery, whereas high schools make use of norms-referenced tests (NRTs; i.e., state end-of-year or end-of-course exams) that rank students in comparison to other students (Tognolini & Stanley 2007). In the case of high schools, students are taught only the material necessary to do well on the criterion-referenced test, as all students are expected to master the subject; assessment of individual performance is emphasized as viewing a student's performance in comparison with others, as is done in NRTs, is seen as unfair to the student (James et al. 2002). As CRTs are to assess students' mastery of a given topic, distribution of these scores is expected to be skewed to the right, as nearly all students are to do well or at least pass the test; in NRTs the distribution of scores is normal, with the majority of students doing well enough and some either excelling or doing poorly, as this type of test is competitive and therefore meant to assess students in comparison with each other's performance.

Recommendations for Coursework

About three quarters of all high school graduates seek additional education within a few years of their graduation, and nearly all of them will advance their education at some point during their lives (ACT 2005; Barth 2003). As ACT (2005) has noted,

Despite the importance of continuing education, too many high school students graduate without the skills they need to be successful in college-level courses. This is especially true for low-income students and students of color, too many of whom were not placed in a college-preparatory curriculum in high school even though research shows that the strength of the high school curriculum is the largest predictor of success in college (Green, Dugoni, Ingels, & Camburn, 1995; Greene & Forster, 2003; Council of Chief State School Officers, 2003) (1).

Because nearly all high school graduates now end up pursuing additional education, ACT recommends that all high school students receive the necessary coursework to prepare them to be

successful in college courses. ACT looked at the relationship between students' core coursework and determined that all high school students needed to math coursework through Algebra II, four years of college-preparatory English, and three or more years of science in order to be successful in college (ACT 2004). More recently ACT insisted that completing the math course sequence of Algebra I, II, Geometry, Trigonometry, and an advanced math as well as a science sequence of Biology, Chemistry, and Physics improved students' odds of passing the COMPASS test and placing successfully into college-level coursework (ACT 2005). Many states have begun adopting these recommended standards, including North Carolina, who will be requiring ninth graders who enter high school in 2012-2013 and beyond, and who are part of the "Future-Ready Core" track, to have four math course credits including Algebra I, II, Geometry, and a "4th Math Course to be aligned with the student's post high school plans" (NC DPI 2010).

However, not all states require such coursework and many have graduation requirements that are out of line with that which would be necessary for a student to be successful in college (Barth 2003). Barth argues that school systems need not be afraid of demanding students enroll in more advanced high school coursework:

Some students will indeed fail intellectually rigorous courses. But it turns out that fewer will fail the more difficult courses than the low-level courses in which we typically warehouse them...The conventional wisdom in American education has it that only the "top" students can handle algebra and high-level English. But not only is the identification of "top" students a slippery affair, the unlucky students classified as "low" ability never have a chance. Clearly these students are able when they have access to the content. But they have to get into the right courses first (2003:27-28).

In short, it appears to be counter-productive to limit the ability of students to earn postsecondary degrees by shying away from providing them with more demanding coursework in high school. The literature demonstrates both that students of all ability levels can handle the additional rigor

and that this more advanced coursework increases the probability of student success in a postsecondary setting.

Human Capital

One reason that human capital theory became a field of inquiry in the early 1960s was the finding of social scientists that additional levels of education accounted for a significant portion of overall income growth; according to Sweetland (1996: 351), the theory itself states that both “Individuals and society derive economic benefits from investments in people.” It seems quite logical to deduce that the amount and quality of education and training an individual receives has an effect on the wages that an individual earns, however Barth (2003) states that:

Despite this, our educational system continues to be stingy when it comes to doling out knowledge, skills and preparation for continuing education. The consequences of our educational parsimony are profound. The U.S. now has the dubious distinction of having the greatest income disparity of any other economically advanced country in the world (Carnevale & Desrocher, 2002). Indeed, the present division between rich and poor is at its widest since the 1920s (Krugman, 2002). And virtually all of this vast and widening income gap has its roots in a knowledge and skills gap that is also the largest in the developed world (19).

Human capital theory could be seen as a sort of blame-the-victim approach and thus its use is frowned upon in some cases, as some see the theoretical argument as saying an individual suffers economically as a result of a lack of investment in himself or herself. To be clear, in this case, the theory is being used to argue that society is suffering economically in part because of an ineffective investment system, or education system, which is not providing individuals with the human capital that society believes it to be providing. There is a connection between the acquisition of human capital and future earnings capabilities of individuals, to the benefit of society at large, and in order for the benefits to outweigh the costs of the education society invests in individuals, it ought to transfer the skills and knowledge that society believes it does.

Theodore Schultz argued that “By investing in themselves, people can enlarge the range of choice available to them. It is one way free men can enhance their welfare” (1961:2). Moreover, society also benefits from investing in individuals and allowing individuals to enlarge their range of choice, and therefore, ability to be competitive in an ever-changing global market.

For the purposes of this research, human capital is defined as the skills and knowledge a person possesses to which society accords value; for this thesis the focus is on the skills and knowledge a student must possess to which the community college system accords the value of “college-level.” The acquisition of the necessary skills and knowledge for placement into credit-bearing coursework increases the likelihood of students’ degree completion; degree completion then, in turn, both provides an individual with the credentials to be competitive and command a higher wage in the job market, as well as providing them with the additional human capital necessary to be successful once a job is acquired. It is not enough for recent high school or college graduates to have the credential; in order to be successful in the job market, especially if one is a minority, they must have the skills and knowledge that that degree connotes. This is important because, as Barth (2003:19) explains, “based on *knowledge and skills* – as opposed to *credentials* alone – the earnings gap between people of color and Whites narrows.”

Allowing for Future Option Returns

Schulz’s conceptualization of education as an investment was expanded by Weisbrod (1962), who argued that investment in human capital provided returns that are external to the student and future option returns, or the ability to receive additional education in the future. Weisbrod explains future option returns through the use of metaphor and compares them with a

person purchasing a machine; the purchasing deal is sweetened when the purchaser is promised a new machine from the seller when the old one no longer works. The same is true of future option – an employer hires a person with the knowledge that that person may receive future education that would increase and/or update their skillset, as necessary. However, those who go to school to improve their skillset for an employer may have greater difficulty gaining a technical or associate’s degree if they require remediation before they may engage in the coursework necessary for the specific degree they are seeking. This placement may block them from future option returns, or make the process difficult and time-consuming.

Additionally, Weisbrod’s concept would be applicable to the Obama administration’s plans to “retool” community colleges. Part of the administration’s goal is to provide programming that would allow companies to sponsor job-training opportunities at the colleges. It is important to note, however, that many of these partnerships already exist, and the companies may (and do) require some of the same core coursework as other degree-granting programs at community colleges already mandate; community colleges require that core coursework be completed for any degree seeking program, including college transfer and technical degrees, some of which partner with employers to provide a desired skill set to create an employment pool⁵ (Cape Fear Community College). Therefore, students who wish to participate in many of these programs would still be subject to placement exams; the human capital that they acquired in high school would still impact their ability to be successful within these new job-training programs. Exposure to the high school coursework that would give the individual the necessary human capital to place out of remedial coursework likely would decrease the probability of placement into remediation, even if the individual works for a while after high school before returning to school; as it would whether the individual plans to attend a university immediately

following graduation from high school, to attend community college with the hopes of transferring to a university, or plans to receive a technical degree. Weisbrod's concept of future option returns facilitates the argument that investment in coursework that better prepares students for college should be made, regardless of whether the student plans to receive any form of postsecondary education in the foreseeable future.

This thesis makes the connection that high school courses can predict passage of College Placement Tests (CPTs), allowing students to enroll in credit-bearing coursework at community college, and this enrollment has been found to increase students' likelihood of matriculation. Human capital theory is then used to make the final connection as well: degree attainment has been shown to increase income and therefore, probability of economic mobility. Borrowing from Weisbrod, it may also be argued that sound secondary education – that is, one that does not limit future educational opportunities – not only improves the economic mobility of the student but benefits family members, neighbors, employers and society as a whole, as employment opportunities for these individuals, and perhaps the ability of those individuals to be contributing members of society, are greatly increased.

Social Capital in the Creation of Human Capital

When considering differential acquisition of human capital, the subject of social capital cannot be ignored. For present purposes, social capital is understood as the social relationships (i.e. ties, networks) in and through which one can acquire human capital. Although social capital was perhaps first discussed by Bourdieu in 1986, important to note in this regard is James S. Coleman's (1988:119) piece "Social Capital in the Creation of Human Capital," which focused

on the impact of three forms of social capital - “obligations and expectations, which depend on the trustworthiness of the social environment, information-flow capability of the social structure and norms accompanied by sanctions” – on the creation of human capital. For present purposes, how do social ties affect degree attainment? Coleman maintains that “closure of social networks” is the most efficient social capital mechanism for the transfer of human capital; shown in Figure 1, networks must be closed in that actors A, B and C must all interact with one another – interactions between actors A & B or A & C do not constitute a closed network if actors B & C do not also interact. Closed networks are vital to the formation of obligations and expectations and also to enforcing norms; the threat of sanction of an actor or the obligation to others within an actor’s network that the actor will follow the norms and expectations of the group lend themselves to higher retention and degree completion. Coleman’s piece focused not only on the impact of the context (social structure) in which actors find themselves but also the role of human agency in the acquisition of social capital and subsequent creation of human capital.

Figure 1. From Coleman’s (1988: 106) Closure of Social Networks

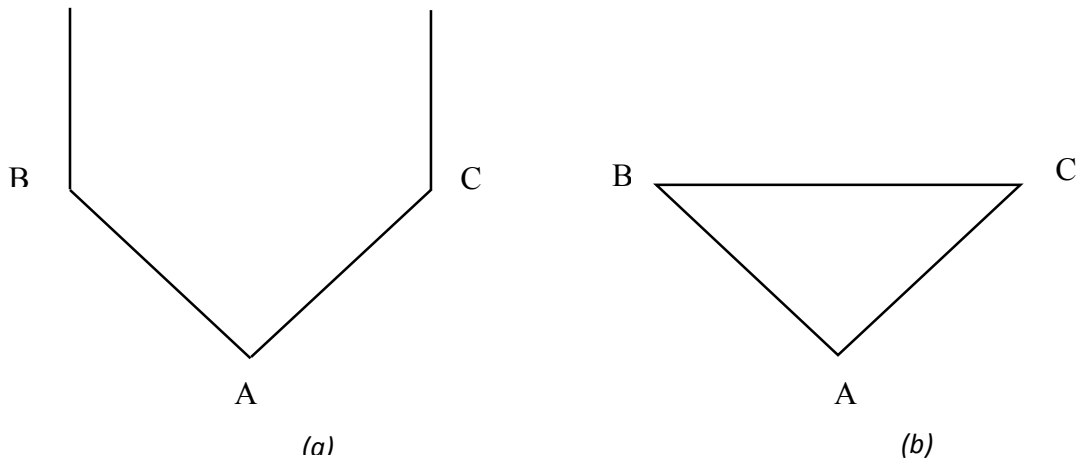


FIG. 1.-Network without (a) and with (b) closure

The ability of groups to create human capital via social capital depends, as Coleman argues, on the context in which they find themselves. For example, African-Americans living in highly concentrated areas of poverty (i.e., public housing) may not have social network closure; disruption in the family, busing, and the oppositional culture⁶ that forms as a result of living in such areas can lead to weak social networks. Immigrants, primarily the children of Mexican migrant workers, often suffer from the inability to have closure of social networks because their parents may not speak English, may be intimidated by the school system and/or may not know how to navigate the system, and are more likely to move their families during an academic year, causing disruption in the relationships that have been formed (Shipler 2004). Also important to consider is that students can at times gain a type of social capital that weakens their ability to acquire human capital: counterfeit social capital (Ream 2003). Students gain counterfeit social capital when teachers utilize a form of defensive teaching where they are more permissive toward a student in order to maintain a healthy classroom environment; this type of social capital was used as an explanation by Ream (2003) when he found that low SES Mexican American students reported an unusually high level of school social capital, but did not exhibit corresponding levels of success in their coursework. This type of social capital does not assist in the creation of human capital, as the student's ability to learn is undermined by the teacher's pacification.

Differential Acquisition of Human Capital

In the wake of recent political movements, much attention has been drawn to class divides by income, tax paid, net wealth, homeownership, and education; whether the “American

Dream” still exists and is accessible to all, or at least most, is now being argued on the national stage, decades after researchers questioned its reality. To wit,

“Promoting an opportunity structure through educational attainment is a critical piece of our social policy, yet several scholars believe that opportunity structure is more fictive than real (Bowles & Gintis, 1976; Brint & Karabel, 1989). Investigating low SES college students' experiences and outcomes also provides insight into how and the extent to which the opportunity structure promotes social mobility” (Walpole:46).

Low SES students use community college as a means to enter post-secondary education; about 26% of students at community college come from low SES families (Furchtgott-Roth et al. 2009). Thus, their ability to successfully place into college-level coursework should be given attention as placement into remediation, as discussed above, greatly reduces their likelihood of completing a post-secondary degree. The second research question, “Does the acquisition of the necessary human capital vary by race, ethnicity, sex⁷ or SES?” will then be analyzed.

As mentioned above, community colleges are required to have what is known as an “open door policy”; that is, if you meet the minimum age requirements, and can afford to pay the minimal tuition you can attend. For this reason, individuals from many low socioeconomic status (SES) groups choose to go to community colleges, often with the plan to transfer into a four year university after completing their Associates degree. Having this open door policy is essential to the future economic mobility of these groups: “Because of [community colleges’] low cost, diverse course offerings, and easy accessibility, community colleges can open pathways to higher earnings for highly diverse groups of students” (Furchtgott-Roth et al 2009:5). When minority students arrive at community colleges they are often at a great disadvantage when compared to their white counterparts; for the purposes of this research, the focus is on one of those reasons – the differential acquisition of human capital by minorities.

As before mentioned, one practice in the educational system that allows students differential exposure to coursework and therefore differential acquisition of human capital are the practices of ability grouping and tracking. Ability grouping occurs early on in students' educational experience; students' "ability level" is determined and students are thereafter grouped either within classrooms, which is more common in primary schools, or between classrooms, which is seen later, during middle school and high school. Ability grouping between classrooms is more commonly known as tracking. Much of the research on this practice points out that tracking puts minority students at a greater disadvantage (Burris & Welner 2005; Chambers 2009; Schofield 2010), thereby widening the achievement gap. Wiggan (2007:322) posited differential student treatment may be to blame for differences between African American and white student performance, stating that "It is evident that all students do not receive the same treatment with regard to their education, but they are all expected, nevertheless, to produce similar outcomes." Other than exposing students to different content, the practice of tracking contributes to the achievement gap in many ways, one of which being that it creates a form of "racial isolation" which Olneck (2005) has argued, "undermines the achievement of initially lower achieving students" (Schofield 2010 p. 1518), and it may limit minority, immigrant and lower SES students' exposure to a higher Math (Roth et al. 2000). In tracking, because the students are separated into different classes, students identified as gifted benefit more than the lower track students because their curriculum is more diverse and teacher's expectations are higher (Rubie-Davies 2010; Wantanabe 2008).

Wantanabe (2008) observed that a latent effect of the North Carolina Accountability Program⁸ was that it limits teachers in lower tracks to teaching exclusively to the End-of-course⁹ (EOC) exams in order to increase test scores. Teachers in lower¹⁰ tracks experience greater

pressure to focus explicitly on the test curriculum in order to receive the monetary reward that the program gives for achieving higher test scores. Teachers in higher tracks do not have to limit their instruction as their students are already expected to have mastered most of the skills required to pass the EOCs; this means students in higher tracks get to work on mastering additional skills like critical thinking (Wantanabe 2008)¹¹. It is important to note that ability grouping begins long before high school, and this thesis will only examine a snapshot of student experience, from high school through their second year of community college; examining the coursework students are exposed to in high school does not capture the extent of differential exposure to coursework between low SES students & higher SES students, African American and Hispanic students and white students.

Replicating the Findings of Roth and Colleagues

In their study, Roth et al. (2000) found that African-American and Hispanic students did not pass their community college placement tests at the same rates as Caucasians, even when the researchers controlled for other variables, including GPA. About 55% of African-American students and 40% of Hispanics did not pass the test, compared to about 25% of Caucasians. According to Roth et al., this variation in passing rates indicates that minority students had not achieved the same level of mastery of the subject matter as whites. Of particular importance in this instance is that the “discrepancy was emphatically not the case for students passing the Math CPT [college placement test] where race differences disappeared for students with similarly substantial coursework in mathematics” (81). This is a key finding, as it shows that what mathematics coursework a student had in high school was of most importance, whereas race was not. Minority students who had the same math

coursework in high school passed the placement exam at the same rate as their white peers; conversely, when they had not had the same coursework in high school the racial gap in test passage widened severely. Often, minority students are disproportionately located within lower tracks (Wantanabe 2008; Burriss & Welner 2005; Chambers 2009; Schofield 2010) and therefore lower level coursework in high school; one might then reach the conclusion that minority students would also be disproportionately located within remedial coursework at community college.

The negative effects of the failure to expose minority students to courses that would give them the necessary human capital to place into college-level coursework are, in fact, reflected by the data on enrollment in community college remedial courses. As mentioned above, African-Americans are almost twice as likely as Caucasians to enroll in at least one remedial course (Greene 2008). The gap between minorities and whites in necessary human capital is further aggravated by the added dimension of gender, as nearly twice as many African American women get bachelor's degrees than African American men (Thompson et al. 2006); the inference being that they are less likely to be placed into remedial courses. It is therefore expected that differences in assignment to remedial coursework will vary by both race and ethnicity and gender, with African American males being the most likely to be assigned to remediation.

Reduced Likelihood of Graduation or Transfer for Remedial Students

The high rate of enrollment of first-year students in remedial courses would not be of such great importance if students placed into those remedial courses were still as likely as students who did not need remediation to transfer or graduate. However,

“The likelihood of attempting a transfer level English course after beginning in a reading fundamentals course at the community college is only 25% (Research and Planning Group for California Community Colleges, 2005). The numbers are more dismal for mathematics. The likelihood of taking a transfer level math course after starting in a basic level math course is only 10%” (Brown & Niemi 2007).

Without completing their remedial education sequence,¹² students cannot complete their degree¹³. This inability to finish their degree has a great impact on their future economic opportunities and returns, especially for already economically disadvantaged students. As noted earlier, roughly 26% of students at community college come from low SES families; this is important to note because

“Past Economic Mobility Project research shows that those born into the bottom income quintile are *four times* more likely to reach the top quintile as adults if they have a four-year college degree. Moreover, without a degree, nearly half (45 percent) of those born into the lowest income quintile remain there as adults” (Furchtgott-Roth et al. 2009).

Students who are enrolled in remedial coursework often do not understand that remedial classes do not carry any college credit; often this lack of understanding is a result of poor advisement by community colleges who would rather not emphasize enrollment in these courses so as not to stigmatize students (Deil-Amen & Rosenbaum 2002). Deil-Amen & Rosenbaum also point out that there is an increased financial and time burden placed on these students, especially those students who must take more than one course in a given area; placement into a remedial math course that is seen as 10th grade level might require three remedial math courses - usually three semesters, as the courses cannot be taken concurrently, depending on the degree the student is seeking. As a result of the increased burden (with lower return) and poor advising most remedial students end up leaving the community college system without securing a degree or transfer to a four-year school.

Using data from the “Achieving the Dream: Community College Counts” study, Bailey (2008) found that at least 60% of students required some remediation in mathematics; nearly a quarter of the sample started out one level (semester) behind in math, 16% were two levels (two semesters; one year) behind and 19% were three levels (three semesters; one and a half years) behind. This is in stark contrast to remediation in reading, where nearly one quarter were one level behind but only 7% were two levels behind and only 3% tested three levels behind college credit-bearing coursework. What Bailey found in this study holds true nationally as well: a student is much more likely to test into a remedial math than they are a remedial reading or writing course.

Studies on these trends - including Bailey’s - focus on how remedial education can be improved, how retention can be increased and how to bridge the gap between high school and community college with better advisement or access to college level classes in high school (also known as dual enrollment). Although dual enrollment has been shown to be successful in preparing students for college-level classes, many schools are not currently prepared to offer such classes and in the interim many cohorts are entering and completing high school without receiving the proper preparation for the expectations of college. This set of circumstances has led to the question: Without changing the overall structure of our high schools, what can be done to lower the numbers of first-year students who enroll in remedial math coursework?

As discussed above, Roth et al. found that exposure to a higher math positively impacts a student’s ability to pass a community college placement test: “even though only 49% of the students who enrolled in Florida community college in the fall of 1994 had taken Algebra 2 in high school, those who did far exceeded the average Math CPT pass rate of 50% achieved that year by all test takers. Even students who did very poorly in Algebra 2 (receiving a grade of D)

achieved a pass rate of nearly 75%” (2000, p. 80). Roth et al.’s sentiments were echoed in the work of Berry (2003: 406): “The data indicate that a fourth year of rigorous high school math, something more advanced than Algebra 2, greatly increased the likelihood that a student would place into college level math... Students who lacked a rigorous high school math course often started college one to three math courses (thus semesters) behind and then stayed behind because of their high failure rate in the remedial courses.”

METHODS

Guided by the existing research on this issue, two questions will be addressed in this analysis: the first is “What core coursework in high school has the greatest predictive value on student enrollment in college-level coursework?” and the latter, “Does exposure to the necessary coursework vary by race/ethnicity, sex, and SES?” Again, in line with prior research, it is expected that a student’s highest math course will have the greatest predictive value on remedial enrollment; African American males are expected to be the least likely demographic to have taken higher math courses.

Sample

This study conducted secondary data analysis on the restricted-use aggregate data collected by the National Center of Education Statistics. The Education Longitudinal Study of 2002 (ELS:2002) is a multilevel longitudinal study that follows a cohort of students from their 10th grade year of high school in 2002 through their second year of college or work in 2006. ELS:2002 is a project run by the National Center for Education Statistics (NCES) under the

United States Department of Education. ELS:2002 is not the first of its kind; the first such study done by the NCES was in 1972; “ELS:2002 is the fourth in a series of school-based longitudinal studies. All of these studies deal with the transition of American youth from secondary schooling to subsequent education and work roles” (ELS 2002). ELS:2002 began in 2002 with a sample of 750 schools, including over 15,000 students. The first follow-up was in 2004, the second in 2006; the final follow-up is to be done this year and, due to the time constraints and narrow scope of this project, will not be included in the dataset. At the second follow-up in 2006, the base year was in their second year of college (if they attended college).

Sampling for the ELS:2002 dataset was a two-stage process, beginning with a stratified probability sample of schools. Out of the 1,220 eligible schools, 750 agreed to participate and provided a list of all sophomores. From that list, a second probability sample was conducted and about 26 sophomores from each participating school were selected for participation. Of the 19,220 students who were sampled, 17,590 were determined to be eligible (were in the spring semester of their sophomore year) for participation; 16,170 of these cases are included in the restricted-use dataset. The ELS:2002 then administered a base-year (2002) survey to the participating high school sophomores, the students’ school administrators, librarians, teachers, parents, oversampling Asian, Hispanic, and private school students; a second student survey was administered two years after the first (in the spring of 2004) when the base-year respondents should have been in their senior year of high school. For the base year, the weighted response rate for schools was 67.8%; for students it was 87.3%, and for parents, 87.5%. At the first follow-up, the sample was refreshed, adding about 240 cases, all of whom were seniors at the time but had been enrolled at another school or were in a grade other than the 10th at the base year; the weighted response rate for students was 93.4%. Transcript data were gathered in the

second wave; the data typically included all of the student's high school coursework. Transcript data is included for 91% of students included in the dataset. A third student survey was administered in 2006, when the base-year should be in either their second year of college or their second year in the workforce; the weighted response rate was 88.4%. The possible limitations of this research as a result of this design include the reliance on self-reports of remedial enrollment at the second follow-up.

Methodology

The variables that are considered in this study are the race and sex of students from the base-year student survey and a composite SES variable from the base-year parent survey; students' highest math in high school number of units taken within core courses (English, science, social studies, mathematics); number of Advanced Placement and International Baccalaureate (AP/IB) courses taken¹⁴; students' overall high school GPA from the transcript data gathered during the first follow-up in 2004; and type of college attending as well as self-reported data from the second follow-up student survey on whether they placed into a remedial math, remedial reading, or remedial writing coursework in college. The variables were located and selected through the use of the electronic codebook that is included as part of the data package that NCES sends to those who obtain a restricted-use license. Frequencies were run on each variable included in the analysis to examine whether the number of missing cases or rate of nonresponse was high; these rates for each of the included variables is relatively low¹⁵, therefore all the intended variables were included in the analysis.

Two of the items included in the analysis were from the base-year student survey, including sex (BYSEX) and race (BYRACE_R). The socioeconomic composite measure (BYSES1)

included in the database was calculated using five variables from the parent survey that was administered during the base-year: both parents' education levels, both parents' occupations, and family income. Several measures included in the analysis are from the students' transcript data; these measures are GPA (F1RGPA), number of AP/IB courses taken (F1APIB), units taken in English (F1RHEN_C), social studies (F1RHSO_C), science (F1RHSO_C), and students' highest math (F1HIMATH). Four items that were included in the model were measured at the second follow-up (2006) student questionnaire:

- F2PS1SEC: Is this school a four-year college or university, a two-year community college or a vocational, technical or trade school? Is this school public, private, not-for-profit, or a private, for-profit?
- F2B16A: At [F2PS1], [have you ever taken/did you ever take] remedial or developmental courses to improve your reading skills?
- F2B16B: At [F2PS1], [have you ever taken/did you ever take] remedial or developmental courses to improve your writing skills?
- F2B16C: At [F2PS1], [have you ever taken/did you ever take] remedial or developmental courses to improve your mathematics skills?

The variables that address remedial enrollment were recoded into binary variables were "yes" or enrollment in remedial coursework was coded as the event, or 1, and "no" was coded as 0. Two additional variables, named TOTALREMEDIAL and ANYREMEDIAL were created using the compute function of the statistical package; the binary recodes (1 = yes) of REM_ENG, REM_SOC, and REM_SCI were added together and the resultant variable TOTALREMEDIAL was then recoded so that 0 = "no" and 1-3 = 1, or "yes." This variable, ANYREMEDIAL, was used in a binary logistic regression model to examine the predictive value of a student's sex,

race, SES, high school GPA, and core high school coursework on postsecondary enrollment in any remedial coursework. All four remedial variables were used as dependent variables (in their respective logistic regression models) to answer the first research question.

The variable for race was recoded so that there were five categories: white (non-Hispanic), black (or African American), Hispanic, Asian, and other. The “other” category included the previous categories of “American Indian/Alaskan Native, non-Hispanic”, “Native Hawaiian/Pacific Islander, non-Hispanic”, and “More than one race, non-Hispanic.” This was done to limit the likelihood of low cell counts; of primary interest to this research was the gap in both high school course taking and remedial enrollment between white and black students. Four dummy race variables were created for use in the regression models, “African American” students being the reference group.

Analysis

Analysis was conducted through the use of the Statistical Package for the Social Sciences (SPSS 20); a license to use the restricted-use dataset was obtained from NCES. To avoid disclosure risks, NCES required that all counts included in this thesis be rounded to the nearest ten. The variable F2PS1SEC was used to select cases for analysis; only cases in which F2PS1SEC = 4 (public, two-year community college) were included¹⁶. There were 16,170 cases in the ELS database and 3,470 of those respondents reported that they were enrolled at a community college when the second follow-up questionnaire was administered. Of the included cases, 55.6% were white, 12.3% were black, 16.6% Hispanic, 10% Asian, and 5.4% other. Female respondents made up 53.6% of the sample. Of the students who were enrolled in

community college at the second follow-up, 1620 (48.8%) reported taking a remedial course: 616 (38%) of those took a remedial course did so in one of the three remedial areas (reading, writing, or mathematics), 460 (28.5%) took remedial coursework in two of the remedial areas, and 540 (33.5%) took remedial coursework in reading, writing, *and* mathematics. As expected, community college students were more frequently enrolled in remedial mathematics coursework (N= 1380) than writing (N= 1060) or reading (N= 920).

Table 1. Descriptive Statistics for Independent Variables and Remedial Enrollment

	N	Valid %	Mean	Std. Dev.	Range
Sex	3320	--	--	--	--
Female	1780	53.6			
Male	1540	46.4			
Race	3310	--	--	--	--
White	1840	55.6			
Black	410	12.3			
Asian	550	16.6			
Hispanic	330	10.0			
Other	180	5.4			
SES	3470	--	-.0422	.66310	3.77
GPA	3470	--	2.6987	.65215	4
AP/IB Courses	3470	--	.0112	1.35066	12
Units of English	3470	--	3.36	2.22	9
Units of Social Studies	3470	--	3.06	2.12	9
Units of Science	3470	--	2.44	1.93	7
Highest Math	3470	--	--	--	--
No Math or Other	30	.8			
Pre-Algebra, General, or Consumer	120	3.4			
Algebra I	210	5.9			
Geometry	540	15.6			
Algebra II	1300	37.6			
Trigonometry, Calculus, or Pre-Calculus	1070	30.9			
Remediation	1620	48.8	--	--	--
Reading	920	26.4			
Writing	1060	30.5			
Mathematics	1380	39.7			

Using the crosstabs function in SPSS with Chi Square (Appendix A), and the computed TOTALREMEDIAL variable, it was determined that there is a statistically significant relationship between a student's race and enrollment in remedial coursework ($p = .000$). White students were the least likely to take any remedial enrollment; 44.3% ($N=780$) of white students reported taking a remedial course; both white males ($N = 470$; 57.2%) & white females ($N = 510$; 54.4%) were less often enrolled in any remedial coursework.

Table 2. Odds Ratio and Significance of the Binary Logistic Regression Models

	Any Remediation (1) $R^2=.042$	Remedial Reading (2) $R^2=.040$	Remedial Writing (3) $R^2=.031$	Remedial Math (4) $R^2=.029$
Constant	.567***	.259***	.280***	.418***
Sex (female)	1.092	.937	.965	1.067
White	.790*	.652**	.949	.852
Asian	1.426*	1.489*	2.154***	1.309
Hispanic	1.120	.909	1.265	1.101
Other	.956	.592*	1.124	.836
SES	.914	.797**	.849**	.969
GPA	1.002	1.001	.997	1.001
AP/IB Coursework	.858***	.872**	.893*	.867**
Units English	.997	.981	.931	1.001
Units Science	1.017	1.105*	1.079	.984
Units Social Studies	1.024	1.020	1.057	1.050
No Math or Other	2.432*	1.642	1.314	2.894**
Pre-Algebra, General Math, Consumer Math	2.541***	2.795***	2.065**	2.323***
Algebra I	1.822***	2.451***	1.902***	1.661**
Geometry	2.002***	1.697***	1.611***	1.834***
Algebra II	1.812***	1.497***	1.446***	1.632***

Note. *Significant at .05 level. **Significant at .01 level. ***Significant at .001.
Cox & Snell R Square was used.

Asian students were proportionally most often enrolled in some remedial coursework ($N= 180$; 55.8%), 54.9% of Hispanic students ($N= 290$) took a remedial course, 52.3% of black students ($N= 200$), and 46.6% of other ($N= 80$). Asian students, both male ($N = 50$; 30.1%) and female ($N = 40$; 25.9%), were most often enrolled in remedial coursework in all three remedial areas.

Using the appropriate binary recodings of the variables for the remedial areas, it was found that white females were least likely to take remedial coursework in reading ($p = .000$; $N = 740$; 77.9%), white males were least likely to take remedial coursework in writing ($p = .000$; $N = 610$; 73.1%), and “other” females were least likely to take remedial coursework in mathematics ($p = .006$; $N = 60$; 70.1%). In a second Chi Square model examining the relationship of sex, race/ethnicity (recoded variable) and highest math course completed in high school, it was determined that African American males ($p = .049$; $N = 40$; 23.4%) and females ($p = .000$; $N = 60$; 23.7%) least often took math above Algebra II. It should be mentioned that while this Chi Square model was statistically significant, multiple cells had low expected counts.

In the first logistic regression model, the effects of a student’s race (African-American students were the reference group), sex, socioeconomic status (SES), students’ core coursework (students’ highest math course in high school and number of units in English, social studies, and science), AP/IB coursework, and students’ GPA on remedial enrollment were examined; those who took “Trigonometry, Calculus, or Pre-Calculus” as their highest math course were the reference group. The odds of enrollment were 1.27 times less for white students than black students. All other things being equal, the odds of enrollment in any remedial coursework for Asians were 1.43 times ($p = .031$) higher than black students. The $\exp(b)$ for SES was .914 and was not significant.

Subsequent models were run looking at the relationship of the control variables to enrollment in each of the remedial areas: reading, writing, and mathematics. A student’s SES had a significant impact on their likelihood of enrollment in remedial reading or writing; other things equal, for every unit increase in SES, a student’s odds of enrollment in remedial reading decreased 1.25 times ($p = .001$) and their odds of enrollment in remedial writing decreased 1.18

times ($p = .009$). Whites, as compared to African American students, were significantly less likely to enroll in remedial reading coursework; other things equal, their odds of enrollment were 1.53 times lower.

All other things being equal, compared to those whose highest math coursework in high school was “trigonometry, pre-calculus, or calculus”, the odds of those whose highest math was “No Math or Other” enrolling in remedial coursework at a community college were 2.43 times ($p = .031$) higher: those who took “Pre-Algebra, General Math, or Consumer Math” were 2.54 times ($p = .000$) higher, “Algebra I” were 1.822 times ($p = .000$) higher, “Geometry” were 2 times ($p = .000$) higher, and those whose highest math coursework was “Algebra II” were 1.81 times ($p = .000$) higher. The influence of these variables on enrollment was present across all four models; other things being equal, the highest math a student took in high school consistently (albeit, to varying degrees) influenced the student’s likelihood of remedial course enrollment.

Table 3. Tolerance and VIF for the Regression Models

	Any Remediation		Remedial Reading		Remedial Writing		Remedial Math	
	Tolerance	VIF	Tolerance	VIF	Tolerance	VIF	Tolerance	VIF
Sex (female)	.982	1.019	.982	1.018	.981	1.019	.982	1.109
White	.388	2.575	.388	2.578	.388	2.575	.387	2.583
Asian	.583	1.714	.582	1.718	.584	1.714	.584	1.713
Hispanic	.499	2.003	.498	2.007	.499	2.003	.499	2.005
Other	.730	1.369	.733	1.365	.732	1.366	.731	1.367
SES	.893	1.120	.895	1.117	.893	1.119	.892	1.121
GPA	.941	1.063	.940	1.064	.941	1.063	.941	1.063
AP/IB Coursework	.495	2.021	.494	2.024	.493	2.030	.494	2.023
Units English	.251	3.986	.249	7.019	.250	4.007	.249	4.019
Units Science	.235	4.250	.233	4.286	.234	4.269	.235	4.264
Units Social Studies	.228	4.393	.227	4.405	.228	4.390	.228	4.386
No Math or Other	.976	1.024	.976	1.024	.976	1.024	.997	1.024
Pre-Algebra, General Math, Consumer Math	.903	1.107	.903	1.107	.903	1.107	.904	1.106
Algebra I	.843	1.186	.844	1.185	.844	1.185	.846	1.182
Geometry	.746	1.341	.743	1.346	.742	1.347	.744	1.345
Algebra II	.708	1.412	.706	1.416	.707	1.414	.709	1.411

Students with AP/IB coursework were significantly less likely to take remedial coursework; for every additional unit of AP/IB coursework, the odds of placement into any remedial coursework decreased 1.17 times ($p = .000$). Each additional unit of AP/IB coursework decreased the odds of enrollment in a remedial reading course 1.15 times ($p = .008$), for remedial writing the odds decreased 1.12 times ($p = .016$), and for remedial mathematics the likelihood was decreased 1.15 times ($p = .002$). This is to be expected as the content of such courses is more advanced than would be offered in its general course equivalent; students who have been exposed to such coursework should have a greater accumulation of human capital that would allow them to place into credit-bearing coursework.

Table 4. Regression Models

	Highest Math Greater than Algebra II Cox & Snell $R^2 = .024$				Number of AP/IB Courses $R^2 = .024$			
	exp(b)	p	Tolerance	VIF	b	p	Tolerance	VIF
Constant	.389	.000	--	--	.284	.000	--	--
Sex (female)	.896	.160	.987	1.013	-.024	.161	.987	1.013
White	1.332	.029	.391	2.558	.058	.032	.391	2.558
Asian	2.650	.000	.609	1.643	.220	.000	.609	1.643
Hispanic	1.067	.677	.505	1.982	.013	.676	.505	1.982
Other	1.172	.454	.737	1.358	.030	.495	.737	1.358
SES	1.320	.000	.904	1.107	.060	.000	.904	1.107

A student's highest math and their enrollment in AP/IB coursework was determined to have the largest predictive value on enrollment in remedial coursework; subsequently, two additional regression models were created in order to determine how a student's race/ethnicity, sex, and SES impacts their likelihood of taking AP/IB courses or a higher math than Algebra II in high school. For the second regression model, AP/IB coursework was examined and it was determined that white students, compared to African American students, take .058 more AP/IB units ($p = .032$); Asian students take .220 units more ($p = .000$). Other things equal, for every

unit increase in SES, number of AP/IB courses increases by .06 ($p = .000$); there is a significant, positive relationship between SES and AP/IB coursework.

In the logistic regression model examining the relationship between race/ethnicity, sex, SES and likelihood of taking a math higher than Algebra II, F1MATH was recoded so that math higher than Algebra II was “1” or the event, and Algebra II or below was “0.” Things being equal, whites had higher odds of taking a higher math than Algebra II in high school than African Americans; they were 1.33 times as likely ($p = .029$). Similarly, odds of Asian students taking a higher math in high school compared to African American students were 2.65 times higher ($p = .000$). For every unit increase in a student’s SES, their odds of taking higher math coursework in high school increased 1.32 times ($p = .000$).

One of the downsides to using binary logistic regression is that tests for collinearity are not included on the output, however these tests can be done using other means. Collinearity statistics were run for each of the four regression models through use of the linear regression test function in SPSS (Menard 2002). The tolerances for the dependent variables were found to be acceptable, the lowest of which (tolerance = .228) was well above the minimum level of .10, or a correlation of .90. The variance inflation factors (VIFs) were all well below 10. The distribution of residuals for each of the models was relatively normal.

CONCLUSIONS

The rates of remedial enrollment in the sample were consistent with the research. Nearly half of the students who reported that they were enrolled at community college at the time of the second follow-up also reported that they had taken remedial coursework. Of that nearly 50%, about 40% had required coursework in only one remedial area. More disconcerting was that one

third of those who reportedly took remedial coursework had done so in all three content areas. There were no data available to determine what amount of coursework a student had taken (or would be required to take) in each of these remedial areas; i.e., whether a student was one, two,

Table 5. Correlation Matrix With All Variables¹⁷ Included in the Analysis

	Female	White	SES	GPA	AP Courses	Units Math	Units English	Units Science	Units Social Studies
Female	1.0								
White	-.013	1.0							
SES	-.078**	.255**	1.0						
GPA	.032	.032	.006	1.0					
AP/IB Courses	.032	-.035**	.029	.127**	1.0				
Units Math	.002	.004	.21	.128**	.715**	1.0			
Units English	.013	.031	.047**	.165**	.642**	.838**	1.0		
Units Science	.028	.033	.033	.144**	.696**	.859**	.835**	1.0	
Units Social Studies	.035*	.040*	.021	.200**	.685**	.822**	.847**	.838**	1.0

three, or more levels behind enrolling in credit-bearing coursework within a specific remedial area is unknown.

In the case of the first hypothesis, “a student’s highest math course will have the greatest predictive value on remedial enrollment,” the null was rejected; the higher a student’s highest math course in high school, the higher the odds for successful enrollment in college-based coursework. This is true in all of the remedial areas; a student’s highest math has predictive value when determining the odds of enrollment in reading, writing, or math - the more math a student takes in high school, the less likely they are to enroll in remediation *of any kind*.

Although a student's highest math was expected to have high predictive power on enrollment, students' other core coursework was expected to have some predictive power as well. Perhaps most surprising is that, holding other things constant, the number of units a student took in English had no measurable impact on their placement into remedial reading or writing coursework. African Americans, male (N= 83; 50.3%) and female (N= 121; 53.8%), were more often enrolled in remedial coursework than white males (N= 352; 42.8%) or females (N= 428; 45.6%).

As a proxy for a variable measuring a respondent's track placement in high school, student's AP/IB course enrollment was controlled. Similar to a student's highest math coursework, the more AP/IB courses a student took decreased their odds of enrollment in remedial coursework at community college. AP/IB coursework is more intellectually demanding and academically rigorous than general coursework and provides students with additional content; it is not surprising then that those students with greater AP/IB coursework exposure would have greater odds of successfully placing out of remedial coursework.

For the second hypothesis, "African American males are expected to be the least likely demographic to have been exposed to higher math courses" the null was also rejected. White and Asian students are more likely to have the requisite mathematics and AP/IB coursework than their African American peers. Additionally, using Crosstabs with Chi Square¹⁸ (Appendix B), it was determined that less than two thirds (64.9%) of African American students had taken Algebra II or above, whereas nearly three quarters of white students (71.5%) had taken such coursework. When it came to taking a math higher than Algebra II, consistent with the hypothesis, African American males were least likely to have taken a mathematics course above

Algebra II (N = 40; 23.4%) in high school, compared to 42.9% of Asian males, 35% of whites, 25.5% of Hispanic males and 27.5% of other.

While Asian students were more likely to place into remedial reading or writing coursework than black students, Asian students most frequently reported having taken Algebra II or above in high school; 75.9% of Asian students had completed Algebra II or above, followed by 70.7% of whites, 64.7% of Hispanics, and 60.7% of African American students. This may explain why the relationship between being Asian as compared to African American and enrollment in remedial coursework disappeared in the remedial math regression model.

Limitations

It is necessary to point out that among the cases included in the model, there were only 26 respondents whose highest mathematics coursework was “No Math or Other” (see Table 1), and that only 120 respondents reported “Pre-Algebra, General Math, or Consumer Math” and 210 respondents reported “Algebra I” to be their highest math coursework. These lower cell counts may be responsible for making it appear as though those who take no mathematics coursework in high school have lower remedial rates than students who took “Pre-Algebra, General Math, or Consumer Math.” They may also be responsible for making it appear as though students who took Algebra I were less likely to need remediation than students who took Algebra II.

When a student’s sex, race/ethnicity, SES, GPA, and other coursework were controlled for, the units of English, Science, and Social Studies had no significant impact on remedial enrollment, with one exception. The analysis yielded a positive, statistically significant relationship between units of science and enrollment in remedial reading coursework. However, it must be stressed that the variable used in the analysis measures only the units of science that a

student took and not which science courses or the level of science course (general, honors, AP, IB, etc.).

Unlike the analysis done by Roth et al, students' grades in individual courses were not considered; therefore, it cannot be said whether the grade that students received in their highest coursework impacted their likelihood of placement into remedial coursework at community college. Future replication research may wish to include this variable in their analysis as it was an important element of Roth et al.'s findings.

One should note that the pseudo R^2 coefficient for this model was Cox & Snells, which is not the same as a regression R^2 ; the highest possible value for Cox & Snells is less than one, so the R^2 coefficient of .042 should not be read as explaining 4.2% of the variance in remedial enrollment through the use of these variables, but rather that *the effect size is weak*. The coefficient is quite low and the model should perhaps be respecified using better predictors; however, considering the variables for students' coursework, GPA, sex, race/ethnicity, and SES are so commonly thought to have high predictive value on future academic success, what relevant variables could be included in the model (without being redundant) to improve it are unknown. Using the "overall percentage correct" output as a proxy for the pseudo R^2 coefficient, the first binary logistic regression model, "Any Remediation" was 56.7% correct, for "Remedial Reading" it was 72.7%, for "Remedial Writing" 69.1%, and for "Remedial Mathematics" it was 61.3%. Therefore, although the effect size of the model is weak, its predictive ability is acceptable.

Public Sociology Implications & Future Research

Consistent with the literature, the higher the math a student takes in high school, the lower the likelihood of enrollment in remedial coursework at community college; also, the more advanced the content of coursework, the less the likelihood of enrollment. Also consistent with the literature is the high rate of remedial enrollment for new high school graduates. It seems, given the consistently high rates of remediation on the postsecondary level, that while many students have obtained the credential of a high school diploma, they do not possess the skills and knowledge that individuals, employers and postsecondary institutions believe that credential to indicate. Although all of the students included in this analysis were newly graduated from high school, nearly half of those who went on to community college required remediation; that is, because they had a diploma they were eligible to attend, but as they had not mastered the skills and/or obtained the knowledge that the institutions believe to be college-level, they were subjected to remedial (basically, high school-level) coursework. In the case of these students, it seems as though they have acquired a sort of counterfeit human capital; while society has invested in these individuals, and they have invested in themselves, the skills and knowledge that they have acquired is not assessed as being as valuable as the resultant credential would lead one to believe; nor is it assessed as being as valuable compared to their peers who have the same credential but received more academically rigorous content while in high school.

As the research indicates, these new high school graduates who have placed into remedial coursework will be less likely to complete their degree and will take more time and spend more money pursuing their degree than those who didn't require remediation. As our society has made the shift into a more technologically driven, post-industrial economy, it is necessary that individuals receive education on the postsecondary level. As President Obama stated during his

recent remarks at the University of Chapel Hill, “In American, higher education cannot be a luxury. It is an economic imperative that every family must be able to afford” (Earnest 2012). While the president was speaking to the upcoming increase in Stafford loan interest rates, it is essential to note that the ability of individuals to receive postsecondary training is central to the American economy, as well as an individual’s future financial stability.

Not all students need a four-year college degree, however, in light of the shifts in economic structure, all students need some sort of postsecondary education. Therefore, in order to allow students to be successful in pursuing degree programs or to allow them the possibility for future option returns, policy makers may want to consider providing all students, regardless of their future plans or determined “ability level,” with the same academically rigorous coursework in tertiary & secondary schools. Several states are currently in the process of shifting their graduation requirements; for example, this year North Carolina will begin requiring that most students take math coursework through Algebra II and beyond in order to graduate (NC Department of Public Instruction 2012). It is important to note that although students will now take the same coursework they may not be taught the same content; students may still, even under the new requirements, be stratified by track.

In addition to contributing to the existing literature on the predictive value of core high school coursework on remedial enrollment, this research was designed to be useful to several publics other than fellow researchers (academics). The cornerstone of public sociology is ensuring that research is disseminated beyond the academy to inform and engage multiple publics. Federal & North Carolina State Legislators, Community College Administrators, and those at the Department of Education as well as the North Carolina Department of Public Instruction (NCDPI) might use this research to inform policy and funding decisions in the future.

Currently, there is no institution that oversees both K-12 education and the community college system. An implication from this research is that meaningful dialogue between these two agencies is vital to alleviate the burden of remedial education at community colleges; currently, the responsibility of addressing this issue is placed firmly on the shoulders of the community college system alone, even though this system only has the power to address remediation and not its prevention. Concrete ways in which this research will be disseminated includes: 1) an executive summary to local legislators; 2) presentation of findings to NCDPI; 3) an op-ed article for state and local press. It is hoped that through the use of these two methods the publics with the capacity to positively impact the issue of remedial enrollment will be reached and engaged in a conversation about these findings and how the research generated by public sociologists can continue to be useful to them.

Simply altering the graduation requirements so that students take Algebra II or above is not enough; to avoid high rates of remedial enrollment, and its high costs, it is necessary to engage students in higher level coursework, but unless that coursework is *more academically rigorous* and *demanding* it will likely not be sufficient to keep the student from placement into remedial coursework. Again, a student's determined academic "ability level" does not dictate whether they will be successful in advanced coursework (Barth 2003). If we are, as a society, investing in students and future employers are expecting that the resultant credentials indicate a student's skills and knowledge, we would be wise to ensure that each student's diploma connotes the same level of mastery; ideally, indicating college-readiness. Society should not pay for that education twice; i.e., funding students' acquisition of a high school degree through funds from the local tax base, and later using state funding to pay for remedial education for those same students on the postsecondary level. In light of these changes to North Carolina and other states'

graduation requirements, future research may wish to consider whether the new requirements have any real impact on students' likelihood of placement into remedial coursework; i.e., whether the content that students are receiving still is stratified by the student's projected future plans and determined "ability level.

APPENDIX

Appendix A: Crosstabs with Chi Square

Computed Total Remedial Variable by Recoded Race Variable & Sex

			White	African American	Hispanic	Asian	Other	Total
Male	No Remedial	Column %	57.2%	49.7%	47.3%	45.8%	53.9%	53.3%
	One Area	Column %	17.6%	18.8%	19.0%	9.8%	18.0%	17.2%
	Two Areas	Column %	11.4%	13.3%	16.0%	14.4%	14.6%	12.9%
	Three Areas	Column %	13.7%	18.2%	17.7%	30.1%	13.5%	16.6%
	Total	Column %	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Female	No Remedial	Column %	54.4%	46.2%	43.3%	42.8%	52.9%	50.2%
	One Area	Column %	19.7%	20.4%	19.0%	15.7%	24.1%	19.5%
	Two Areas	Column %	12.8%	14.7%	19.0%	15.7%	14.9%	14.5%
	Three Areas	Column %	13.1%	18.7%	18.7%	25.9%	8.0%	15.8%
	Total	Column %	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Total	No Remedial	Column %	55.7%	47.7%	45.1%	44.2%	53.4%	51.7%
	One Area	Column %	18.8%	19.7%	19.0%	12.9%	21.0%	18.4%
	Two Areas	Column %	12.2%	14.1%	17.7%	15.05	14.8%	13.7%
	Three Areas	Column %	13.4%	18.5%	18.3%	27.9%	10.8%	16.1%
	Total	Column %	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Sex-composite		Value	df	Asymp. Sig. (2-sided)
Male	Pearson Chi-Square	37.037 ^e	12	.000
	Likelihood Ratio	34.900	12	.000
	Linear-by-Linear Association	14.042	1	.000
Female	Pearson Chi-Square	38.252 ^e	12	.000
	Likelihood Ratio	37.210	12	.000
	Linear-by-Linear Association	12.276	1	.000
Total	Pearson Chi-Square	72.286 ^e	12	.000
	Likelihood Ratio	68.672	12	.000
	Linear-by-Linear Association	26.205	1	.000

Appendix B: Crosstabs with Chi Square

Crosstabs with Chi Square: Recoded Highest Math Variable x Recoded Race Variable & Sex

		White	African American	Hispanic	Asian	Other	Total
Male	Algebra I or less	8.9%	11.7%	14.4%	7.3%	10.7%	10.0%
	Geometry	15.1%	20.2%	16.9%	12.0%	20.2%	16.0%
	Algebra II	38.8%	43.6%	41.9%	34.7%	39.3%	39.4%
	Trigonometry, Pre-Calculus, Calculus	37.25	24.5%	26.7%	46.0%	29.8%	34.5%
	Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Female	Algebra I or less	11.0%	14.5%	12.0%	7.5%	11.1%	11.3%
	Geometry	15.8%	22.0%	19.4%	10.6%	15.3%	16.7%
	Algebra II	42.7%	37.4%	42.4%	31.9%	41.7%	40.9%
	Trigonometry, Pre-Calculus, Calculus	30.5%	26.2%	26.1%	50.0%	31.9%	31.1%
	Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Total	Algebra I or less	10.0%	13.3%	13.1%	7.4%	10.9%	10.7%
	Geometry	15.5%	21.2%	18.3%	11.3%	17.9%	16.4%
	Algebra II	40.9%	40.1%	42.2%	33.2%	40.4%	40.2%
	Trigonometry, Pre-Calculus, Calculus	33.6%	25.5%	26.4%	48.1%	30.8%	32.7%
	Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Sex-composite		Value	df	Asymp. Sig. (2-sided)
Male	Pearson Chi-Square	30.811 ^b	12	.002
	Likelihood Ratio	30.677	12	.002
	Linear-by-Linear Association	1.258	1	.262
Female	Pearson Chi-Square	40.264 ^a	12	.000
	Likelihood Ratio	38.156	12	.000
	Linear-by-Linear Association	2.441	1	.118
Total	Pearson Chi-Square	61.448 ^a	12	.000
	Likelihood Ratio	59.923	12	.000
	Linear-by-Linear Association	.141	1	.707

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ENDNOTES

¹ When discussing remedial education, the choice to use either the term “developmental” or “remedial” is often one of preference; in this thesis, “remedial” is used, rather than “developmental.” While developmental education refers to below college-level coursework, it may also be applied when talking about courses that are focused on helping those students with learning disabilities or other issues. Remedial education may only be used when talking about below-college level courses; a remedial course is therefore developmental, but not all developmental courses are remedial.

² The studies of Barth (2003) and The ACT (2004) were among the first to put forth recommended guidelines for students who wish to be successful in college-level coursework; the predictive value of core coursework on placement into credit-bearing college coursework was examined.

³ Is addressed in the “Reduced Likelihood of Graduation or Transfer for Remedial Students” section of this thesis.

⁴ The COMPASS is the ACT’s College Placement exam; one of the more commonly used placement exams at community colleges. ACCUPLACER is administered through The College Board, who also administers the SAT.

⁵ For example, at a local community college, the “Nuclear Technology” degree was born out of a partnership with GE and Granite. This degree (as any degree) has core requirements including ENG 111 and MAT 121; students who wish to complete the program must take and pass a placement exam in order to begin working toward the completion of that degree (CFCC 2012).

⁶ To be clear, oppositional culture is used here to mean the norms and values that are developed in areas of highly concentrated poverty as a result of alienation, or what William Julius Wilson calls the “ghetto culture” or to describe those who exhibit adherence to the norms of what Elijah Anderson would call “street families”; it is **not** meant to say that African American students do not have positive feelings toward school, or oppositional school culture, that James Ainsworth-Darnell and Douglas Downey argue is not a suitable explanation for the achievement gap in their 1998 piece “Assessing the Oppositional School Culture Explanation for Racial/Ethnic Differences in School Performance.”

⁷ The variable “sex” is included in this question as a means for examining the intersectionalities of race/ethnicity, sex and socioeconomic status. Sex by itself is not going to be examined to any great extent, as there has been much improvement in the educational attainment of females, to the point which they now have reached parity with males in their postsecondary accomplishments.

⁸ The North Carolina Accountability Program, also known as the ABC’s (Accountability, Basic skills and local Control) of Education Program was initiated in the early 1990’s and places emphasis on school-wide and teacher gains in scores rather than the student scores themselves (Ladd 2004).

⁹ State-mandated standardized test that is administered annually.

¹⁰ Wantanabe (2008) calls them “regular” tracks.

¹¹ No Child Left Behind (NCLB) was instituted as a result of the “successes” of North Carolina and Texas’s high stakes accountability programs (Ladd 2004; Wantanabe 2008) as a means to close the Achievement Gap, it has done little to do so, as Wantanabe found that minority students and students with low socioeconomic backgrounds still fill the lower tracks.

¹² Remedial education sequence is the coursework that the student has placed into which must be taken sequentially (if they test three levels behind, they must take the lowest level and then work their way up) prior to taking college-transfer courses which bear credit and count toward their degree. Again, remedial coursework does not bear credit or count toward a degree but does cost the student time and money.

¹³ Some community college students allow students to enroll in college-level coursework (against advice) without taking the remedial courses into which they have been placed. If students can receive a passing grade in the college-level work, they get credit for the course but this rarely happens.

¹⁴ Used as a proxy for track; although students may have the same number of units in a core area, Advanced Placement and International Baccalaureate coursework provides students with additional content.

¹⁵ Originally a variable documenting students’ transcript indicated curriculum concentration (academic or occupational) was intended to be included in the analysis as a control for students’ track, however, after frequencies were run it was determined that too many students fell into the “other” category (64.5%) for the variable to be used.

¹⁶ There may be some right side bias as only remedial enrollment at community colleges, and not all postsecondary institutions, were included for analysis.

¹⁷ Units of Mathematics, or F1RHMA_C was used in lieu of F1HIMATH for the correlation matrix

¹⁸ While the model was significant ($p = .000$), several cells had low counts.