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The Relationship between Mathematics Achievement and Socio-Economic Status

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Abstract

This study investigated the relationship between the mathematics scores of public middle school students in Miami-Dade County on Florida's standardized test, the Florida Comprehensive Assessment Test (FCAT) 2.0, and students' socio-economic status. The study found that SES had a strong correlation with the standardized test mathematics scores (r = -.830). The study concluded that the standardized test mathematics scores of Miami-Dade County Public Schools middle school students have a significant negative relationship with SES.

Introduction

It can be said that in American culture all residents of the United States are connected in the sense that in exchange for living up to social responsibilities they are entitled to opportunity, rights, freedom, and justice. As stated by Moore (2002),

> American students, regardless of race, ethnicity, or religion, would be bonded by a common American culture, understand and accept the academic standards established by society and strive to fulfill their individual potential in a democratic society characterized by equal opportunity, individual rights, and responsibilities, freedom, and social justice. (p. 246)

The socio-economic status (SES) of different groups (with regard to their education, health, assets, and relationships) of people in the U.S. has created segregation among the country's population (Kahlenberg, 2000). The segregation of a school often reflects the neighborhood's demographics; usually the more segregated the school, the lower the level of student achievement (Rumberger & Palardy, 2005). Rumberger and Palardy (2005) pointed out that "minority students are more likely to attend large, high-poverty urban schools with fewer qualified teachers and more traditional organizational features that inhibit student learning" (pp. 130-131). Schools that are in the same district, but located in neighborhoods of differing SES display a large disparity in opportunities and quality of education offered to students. Educational opportunities are "unequally distributed among individuals of varying SES," posing "concerns and challenges in societies that value equal opportunity irrespective of socio-economic background" (Caro, 2009). This "gap in achievement between minority and non-minority students has become a national priority" (Brown-Jeffy, 2008).

Regardless of the school the child attends or the neighborhood the child lives in, quality education and resources must be provided and made available in order for the child to be academically successful. From the moment children are born, they are learning: how to walk, read, talk; how to do everything (Chemerinsky, 2005). Thirteen years ago, "Congress passed the

No Child Left Behind Act, which legislated that race and class gaps in academic achievement be eliminated by 2014" (Nisbett, 2011). As implied by the name of the No Child Left Behind Act of 2001, no child should be left behind since it mandates that all children receive a high-quality education. "At the beginning of the twenty-first century, the issue is not education in general, but quality education" (Perry, T., 2010, p. xi).

This study is part of a broader research that investigated the relationship between mathematics achievement on the Florida Comprehensive Assessment Test (FCAT) 2.0, socio-economic status, racial/ethnic concentrations, ESOL, and school climate in the author's Doctoral dissertation (Galindo, 2013). In this article, the relationship between the FCAT 2.0 mathematics scores and SES is presented.

Statement of the Problem and Purpose

The problem examined in this study was to determine if a significant negative relationship exists between the FCAT 2.0 mathematics scores and SES for the 2010-2011 school year. The purpose of this study was to investigate the relationship between the standardized test mathematics scores of public middle school students in Miami-Dade County, Florida and SES for the 2010-2011 school year. SES has been linked to academic achievement, so an ability to analyze it was sought. (Levin, 1998; Williams, 1999; Freire, 1970; Delpit, 1995; Cortes, Jr. 2010; Brown-Jeffy, 2008; Rowley & Wright, 2011; Nisbett, 2011)

Research Question

The following research question was formulated to guide this study:

1 Is there a significant negative relationship between the FCAT 2.0 mathematics scores and SES?

Research Hypothesis

The following research hypothesis was formulated to guide this study:

H_{01}: There is a significant negative relationship between the FCAT 2.0 mathematics scores and SES.

Methods

Miami, Florida is home to a variety of immigrants: some highly successful, while others struggle to meet their needs. Currently, Miami-Dade County Public Schools (Miami-Dade) is the fourth largest public school system in the nation (Miami-Dade County Public Schools, 2013).

For the 2010-2011 school year, there were a total of 59 public middle schools in Miami-Dade and that were used in this study. According to Miami-Dade's *Statistical Highlights* (2010-2011), there were a total of 80,113 public middle school students (Miami-Dade County Public Schools, 2011). Of the total number of public middle school students, 75.5% were Title I and eligible for free/reduced lunch (Miami-Dade County Public Schools, 2011). The FCAT 2.0 Mathematics Test (2011) provided the scores to measure mathematics achievement. FLDOE's *2011 AYP*

Report provided data from the 59 different public middle schools on the number of Title I (Economically Disadvantaged) students tested, which is the number used to represent SES.

The independent variables have already occurred; hence it is an ex post facto research. This method allowed for the discovery of a relationship among the variables. The independent variable in this study is SES. The dependent variable in this study is the scores of the middle school students on the FCAT 2.0 Mathematics Test for the 2010-2011 school year. These scores and results have already occurred and cannot be manipulated.

Multiple Linear Regression (MLR) was used to test the hypotheses. It determined if there was a significant relationship between middle school students' mathematics scores on the standardized test and SES. Furthermore, for this study, an alpha level, P_{crit}, of 0.01 was used, which allows the study to be replicated 72% of the time (Newman, McNeil, & Fraas, 2003). Studies using a 0.05 alpha level can only be replicated 50% of the time. The software that was used to perform the statistical analyses is IBM SPSS Statistics 20.

Results

For this study, significant variance is sought between the standardized test mathematics scores of the public middle school students and SES. As shown in Table 1, the correlation between the students passing the FCAT 2.0 Mathematics Test and SES is -0.830. It is a strong correlation because the *r* is between -0.7 and -1 but, it is also a negative correlation meaning that as the number of low SES increased, the percentage of the students passing the FCAT 2.0 Mathematics Test decreased.

Table 1 shows the result of the research hypothesis (H_{01}). The P_{crit} established for this study is 0.01. The P_{calc} for the relationship between the SES and the students passing the FCAT 2.0 Mathematics Test is $p < 0.001$, making it statistically significant since it is less than 0.01 and not rejecting the research hypothesis (H_{01}). This means that a significant negative relationship exists between the standardized test mathematics scores and SES. There is a 1% chance that a Type I Error was made and the research hypothesis is incorrect.

Table 1

Pearson r and Sig. (1-tailed) - Relationship of FCAT 2.0 Mathematics Scores and SES

Total %[a]	Passing FCAT Math	SES	
Pearson Correlation	Passing FCAT Math	1.000	-.830
	SES	-.830	1.000
Sig. (1-tailed)	Passing FCAT Math	.	.000
	SES	.000	.

Note. $a = 59$.

Table 2 shows a strong correlation of 0.830, *R*, of SES with the dependent variable. The R^2 is 0.688, which is the amount of variance in the dependent variable that can be explained by SES. SES explains 68.8% of the variance. The Adjusted R^2 was used for the study because it is more accurate for explaining variance. The Adjusted R^2 is 0.683, less because it adjusts for any bias by correcting the R^2's value, and thus explains 68.3% of the variance. Hence, SES explains 68.3% of the variance in the standardized test mathematics scores. (Hinton et al., 2004)

Table 2

Model Summary - Relationship of FCAT 2.0 Mathematics Scores and SES

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.830[a]	.688	.683	9.024	.688	125.878	1	57	.000

Note. a. Predictors: (Constant), Total % of SES
b. Dependent Variable: Total % Passing FCAT Math

Table 3 shows the Sum of Squares Total is 14892.765, representing all the variance in the data. The Sum of Squares Regression is 10250.929, the variance that can be explained. The Sum of Squares Residual is 4641.837, the variance that cannot be explained. For the Significant column, $P_{calc,}$ it is statistically significant because $p < 0.001$ hence it is less than 0.01, thus it does not reject the research hypothesis (H_{01}), meaning a significant negative relationship exists between the standardized test mathematics scores and SES. (Hinton et al., 2004)

Table 3

ANOVA - Relationship of FCAT 2.0 Mathematics Scores and SES

Model	Sum of Squares	df	Mean Square	F	Sig.	
1	Regression	10250.929	1	10250.929	1215.878	.000[b]
	Residual	4641.837	57	81.436		
	Total	14892.765	58			

Note. a. Dependent Variable: % Passing FCAT Math
b. Predictor: (Constant), % of SES

Table 4 shows how much the variable contributes to the research question for this particular test. According to the Beta results, SES has a strong contribution on the passing of the FCAT 2.0 Mathematics Test (-0.830). For the Sig. column, SES makes a significant contribution to the dependent variable ($p < 0.001$).

Table 4

Coefficients - Relationship of FCAT 2.0 Mathematics Scores and SES

Model Total %	Standardized Coefficients	t	Sig.	
	Beta			
1	(Constant)		20.583	.000
	SES	-.830	-11.220	.000

Table 5's Part column under Correlations, after squaring the values SES contributes 68.89% to the dependent variable, meaning it also explains 68.89% of variance in the dependent variable and will cause the R^2 to drop 68.89% if it is not included in the model. Also, Table 5 displays data that makes it known if multicollinearity is present amongst the independent variables being tested. Since there is only one independent variable being tested, there is no multicollinearity.

Table 5

Coefficients Continued - Relationship of FCAT 2.0 Mathematics Scores and SES

Model	Correlations	Collinearity Statistics		
	Part	Tolerance	VIF	
1	(Constant)			
	SES	-.830	1.000	1.000

Discussion of Findings

SES is a strongly correlated variable with the passing of the FCAT 2.0 Mathematics Test. "Socio-economic status has the strongest influence on student academic achievement indicating that an individual's poverty status has a greater influence on their academic achievement than any other characteristics" (Brown-Jeffy, 2008). The relationship is such that as the number of low SES increased, the percentage of students who passed the FCAT 2.0 Mathematics Test decreased. This relationship was negative and strong. This result is in agreement with the Coleman Report which found that SES is the single most powerful predictor of academic achievement (Coleman, 1966). Nisbett (2011) states that "people with low SES have lower IQ test scores." Low SES is composed of various intricate and complex factors such as segregation, poverty, homeownership, parental influence, parental involvement, parents' education, and family structure. Previous studies such as Coleman (1966), Berliner and Biddle (1995), Valencia (1997), Borman et al. (2004), Street (2005), Cortes Jr. (2010), Brown-Jeffy (2008), Rowley and Wright (2011) and Nisbett (2011) found that low SES has a negative relationship on students' academic achievement.

The data indicates that high levels of families in low SES situations have a negative relation to the mathematics achievement of public middle school students in Miami-Dade County. "Students who reside in substandard housing and attend schools with limited resources are expected to attain the same level of success as students who attend schools with a plethora of educational resources that are located in middle-class neighborhoods" (Ethington & Wilson, 2010, pp. 19-20). There may be just one parent, lack of involvement, interest, support, limited adult supervision, absence of books and educational resources at home, and no structure at home, all necessary for students to succeed (Hofferth & Sandberg, 2001). Low SES is also connected with other factors such as high levels of racial and ethnic concentrations in neighborhoods and schools, high English Language Learner population in schools, and negative school climate among many factor that have an adverse relationship to improve the academic achievement of minority populations (Williams, 1999).

Even though various educational policies (e.g Title I, Title VII, Goals 2000, and No Child Left Behind) have existed for over a decade, the needs of students in low SES situations continue to not be met. Meeting the needs of low SES students is difficult due to various outside factors that are complex such as economic situation (of the family and/or of the broader community), politics, parental choices, crime rates, demographic conditions, limited resources at the schools and / or insufficient professional development opportunities for teachers (Hofferth & Sandberg, 2001; Ethington & Wilson, 2010). This has led teachers to want to leave low SES schools to go teach at schools that equip them with the necessities for students to succeed or just leave the field altogether (Ethington & Wilson, 2010). All these factors are beyond the control of educators, but these factors are part of low SES and so greatly relate to students' academic achievement. "Since the No Child Left Behind At of 2001 specifically focuses on reducing the academic achievement gap between Whites and minorities and improving the achievement of the economically disadvantaged, the results of this study do not support the initial effectiveness of the NCLB policy" (Rowley & Wright, 2011).

Conclusion

Based on the results of the study, low SES has a significant negative relationship with mathematics achievement. As the amount of students in low SES situations increases in public middle schools in Miami-Dade County, the percentage of students passing the FCAT 2.0 Mathematics Test decreases.

Miami-Dade, along with the rest of the country, have made efforts to meet the needs of students in low SES situations by adopting educational policies such as Title I, Title VII, Goals 2000, and No Child Left Behind. Unfortunately, these educational policies have not been effective in eliminating the correlation between a high number of low SES and low standardized test mathematics scores, suggesting that the needs of students in low SES situations are not being met (Gonzalez, 2005). With a county population of 2,496,435 people, only a little more than half the population of Miami-Dade County, 58.3%, are homeowners, and 17.1% are living below the poverty line (U.S. Census Bureau, 2010a). With these demographics, it makes it difficult to meet the great amount of needs of students living in low SES situations.

Recommendations

In order to realize the ideal of offering a quality education to all students, a few steps must be taken to transform the status quo. These recommendations can easily be applied to other districts in similar situations. The current educational policies need to be evaluated to make sure that they are effective in meeting the needs of the students and providing a quality education. It would also merit evaluating whether if funding is applied effectively on programs yielding a higher degree of success. This opportunity would allow the allocation of funding into new initiatives such as offering additional mathematics classes and three nutritionally-balanced meals to qualifying students.

Requiring students who do not pass the standardized test will take additional mathematics classes to help reinforce their skills. Such a program could be targeted primarily at schools with a high number of students in low SES situations. Offering tutoring sessions before the start of the school day, after the end of the school day and on Saturdays to students not passing the standardized test could help students better grasp the mathematical concepts. This extra learning time could allow for re-teaching and reinforcing of the mathematical concepts. Funding may come from monies reallocated after re-evaluating the educational policies.

Also, offering the students in low SES situations the choice of eating dinner, in addition to breakfast and lunch, for free or a reduced price on a daily basis can lead to improvement in the standardized test mathematics scores. This could help students eat three nutritionally-balanced meals a day and help them stay healthy and focus better in their classes. Reducing illness from poor nutrition can help improve students' academic achievement in mathematics and all subject areas (Cortes, Jr. 2010). Again, funding may come from monies reallocated after re-evaluating the educational policies.

The problem of low mathematics test scores at schools with a high number of students in low SES situations deserve more attention and policies, since it is clearly to effectively meet the needs of these students and live up to the opportunities promised by the American dream.

Recent test scores indicate that efforts to improve the mathematics achievement of students in low SES situations have not worked. Departments of Education, school districts, and educational leaders must endeavor in effectively meeting the needs of these students so that they may live up to the opportunities promised by the American dream.

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