Factors Associated with Academic Achievement

of Academically Talented Students:

A Comparison of Four Ethnic Groups

Hae-Seong Park, Ph.D.

Azusa Pacific University

Paper submitted for the Outstanding Paper Award

of 2010 California Educational Research Association

PURPOSE OF STUDY

The purpose of this project is to test a conceptual model, explaining the relationship between parent education level, poverty, family academic resource, gender, academic aspiration, and self confidence with mathematics achievement of academically talented students across four ethnic groups. They are as follows: African-American, Asian-American, Hispanic, and Caucasian. To compare the relationships between the variables in the four ethnic models, multi-group analyses of the path model were performed with Analysis of Moment Structures (AMOS).

THEORETICAL FRAMEWORK

In spite of ethnic minorities making up 53% of California's population, the field of gifted education has faced the criticism that ethnic minority groups are underrepresented. More specifically, the underrepresentation of African Americans and Hispanics compared to Caucasians and Asian-Americans among academically talented students in California is alarming. Recent studies continue to document this longstanding pattern (Jarvis, 2009; Lee, Mathews, & Olszewski-Kubilius, 2008; Mattai, Wagle, & Williams, 2010; Parris, Owens, Johnson, Grbevski, & Holbert-Quince, 2010), not only for California but also for the United States. In addition, all social class divisions of these groups are underrepresented in the nation's top students (Miller, 2004).

Several studies have been conducted to propose solutions for this issue. The most and dominating approach to determine the reasons for underrepresentation of ethnic minority groups has been associated with the biases or inequalities in the procedure for identifying gifted students. For example, some gender stereotypes such as excuse for males being disorganized still existed (Callahan, 2005). McBee (2006) maintained that biases in nomination rather than assessment are

the major cause of underrepresentation for minority and low-SES students in gifted education. Another approach was related to the qualification of teachers and effectiveness of the indentifying procedures. A number of educational policy makers have proposed remedies to solve the problems through instructional changes, creating new environment, training teachers' deficit perception, and raising awareness about culturally and linguistically diverse populations (Bonner & Jennings, 2007; Ford & Grantham, 2003; Hertzog, 2005; Mattai, Wagle, & Williams, 2010).

However, to reveal the nature of the underrepresentation problem of African Americans or Hispanics, many studies have focused on how school and family variables influence these minority ethnic group students' academic achievements. During recent years, researchers investigated indirect but important environmental factors rather than direct causes of the underrepresentation for the minorities. Several researchers (Chavkin & Gonzalez, 2000; Hassinger & Plourde, 2005; Nebbitt, 2009) determined that self-concept and educational aspiration are major factors of academic achievement for African Americans or Hispanics. A recent quantitative study (Nichols, Kotchick, Barry, & Haskins, 2010) with socioeconomically disadvantaged students concluded that parent education, parent participation, and academic self-concept are the main factors that influence educational aspiration in African American adolescents. However, most studies regarding the improvement of academic self-concept or self-esteem have investigated at-risk students rather than academically talented students. Thus, educational policy makers have proposed improving self-esteem as a major part of intervention programs in order to assist at-risk students in completing their schools.

Moreover, regarding academic achievement, consideration for parent education level is needed because it is the strongest predictor in forecasting the students' achievements in minority

ethnic groups. To identify and select fairly and efficiently gifted students within these ethnic groups, the impact of their parent education on academic achievement should be closely assessed and considered during the procedures. Spera, Wentzel, and Matto (2009) revealed that parental education and children's academic performance were significantly and positively related to students' academic aspirations for all four ethnic groups. Interestingly, Grantham (2004) maintained that African-American students' decision to not participate in gifted programs is the main reason for the underrepresentation of African-Americans. He insisted that African American students' decision was usually based on external pressures, particularly negative peer influences, as well as internal issues, namely racial identity status.

Although many studies have conducted to reveal significant variables in school or family contexts, they are unable to fully accomplish this. The reason is that their samples were only from the general population. Therefore, a quantitative study to test the conceptual model and to determine the factors for only academically talented students is needed. When we consider only academically talented students in our conceptual model, the variance of the endogenous variable will be more homogeneous. Consequently, we will lose the rich information (i.e., variability) comparing the general population. Thus, it is imperative to test an applicability of the conceptual model from the general population to the academically talented student group.

In addition, this project employed an international assessment dataset. In spite of several studies having attempted to determine the predictors of high achievement, there has been little research employed international assessment data. As competition becomes rigid with other countries, an international comparison provides a clear perception of the United States' capacity to endure in a global competition.

RESEARCH QUESTIONS

Based on the previous literature findings, the following research questions were developed:

Q1. Are there significant relationships between parent education level, poverty, family academic support, and gender with self-confidence or academic aspiration for academically talented students?

Q2. Are there significant relationships between self-confidence, academic aspiration and mathematics performance for academically talented students?

Q3. If significant relationships exist, is the pattern of the associations consistent across four ethnic groups of the talented students?

In addition, it was hypothesized that the conceptual model would provide an adequate fit to a sample of four ethnic groups of student. However, certain paths or relationships might be more significant for one ethnic group than the others. Although the conceptual model for the academically talented students was tested in this study, the comparison for the four ethnic multigroup was more exploratory in nature. Thus, a specific hypothesis for the paths of each ethnic group was not articulated.

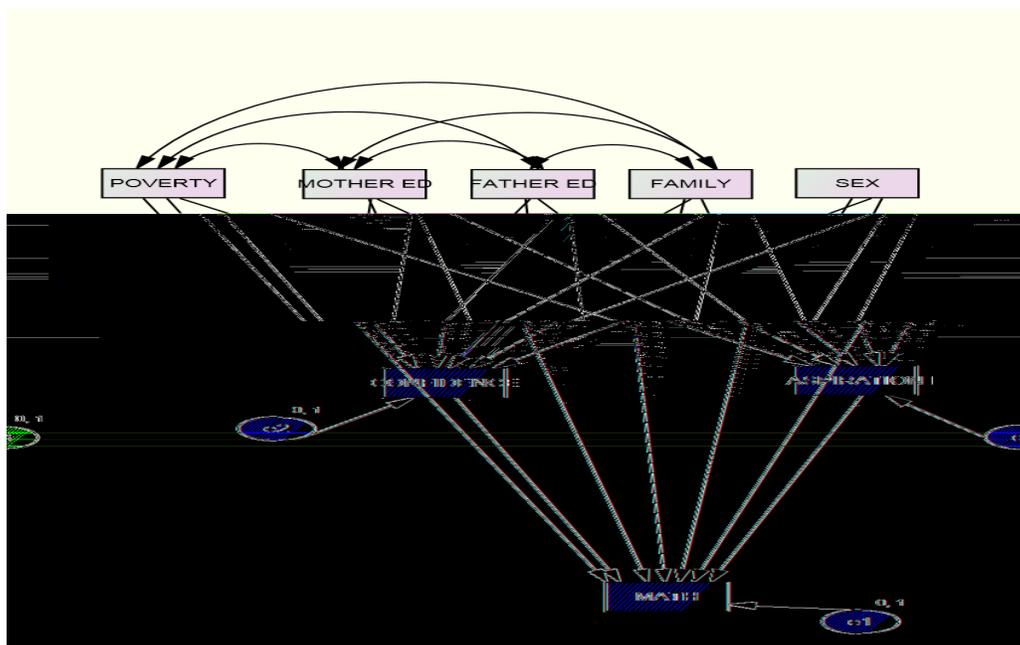The conceptual path model is displayed in Figure 1.

Figure 1. Conceptual Model

METHODOLOGY

Participants

This study utilized data from the Trends in International Mathematics and Science Study 2007 (TIMSS 2007). In order to determine the predictors of high achievement on international assessments of mathematics, the subgroup data for the United States students in the TIMMS 2007 was obtained. For the purpose of the current project, the TIMSS 2007 database was restricted to academically talented students who obtained more than 550 points from the mathematics proficiency test scores. The range of scores was from 258 to 762. In addition, all variables were examined through the SPSS program for missing values and fit indices between their distributions and the assumptions of the statistical analyses. The resultant sample consisted of 1,596 Caucasians, 79 African Americans, 248 Hispanics, and 114 Asian Americans. Therefore, the total number of students in this project was 2037 eighth graders.

Variables

Table 1 lists the variables in this study

Table 1: Descriptions for the Variables

Variables	Description
Mathematics Achievement	This test score came from the IRT scaling approach that makes use of a plausible value or multiple imputation methodology to obtain proficiency scores in mathematics and science for all the pupils who participated in the survey. According to the TIMSS 2007 user guide, plausible values are the best available measures for pupil achievement, and should be used to measure outcomes in studies of pupil achievement. For the current sample, this measure ranged from 550 (the lowest achievement) to 762 (the highest achievement) with a mean of 596.
Gender	This variable indicates students' sex that valued 1 as girls and 2 as boys. For the current sample, there were 993 girls and 1,044 boys.
Mother Education	This scale measured the highest educational level of the mother. The measure ranged from 1 (finished elementary or did not go to school) to 8 (finished master degree or higher).
Father Education	This scale measured the highest educational level of the father. The measure ranged from 1 (finished elementary or did not go to school) to 8 (finished master degree or higher).
Family Academic Resource	This variable measured the number of books in a student's home. The measure ranged from 1 (none or few books) to 5 (3 or more bookcases- more than 200 books).
Poverty	This inverse index is the total number of possessions based on the following nine items: calculator, computer, study desk, dictionary, internet connection, encyclopedia, video game system, VCR or DVD player, and 3 or more cars. The range of this variable is from 0 (none) to 9 (all).
Self- Concept	This variable measured a student's academic self concept with mathematics. This scale asked students how much they agreed that they performed well in mathematics. This recoded variable ranged from 1 (disagree a lot) to 4 (agree a lot).
Academic Aspiration	This variable measured a student's educational aspiration. The question asked students how far they expected to pursue their education. The values of this measure is 1 (finish high school), 2 (finish vocational certificate after high school), 3 (finish community or junior college), 4 (finish bachelor's degree), and 5 (beyond bachelor's degree).

Analytic Strategy

Multi-group analyses of the path model were performed with AMOS (Byrne, 2001). AMOS stands for Analysis of Moment Structures and is a structural equation modeling software. In this path model, mother education level, father education level, poverty, family academic support, and gender served as exogenous variables predicting mediating variables: academic self confidence with mathematics and academic aspiration. However, all these exogenous variables and the mediating variable predicted the final endogenous variable: mathematics proficiency scores.

Because of missing values in the variables, "full information maximum likelihood estimation" procedures were employed in the analyses. This minimizes the biases due to nonrandom missing data that would result from methods such as listwise deletion of missing values (Arbuckle, 1996). The overall fit of the models was examined through several indicators such as model chi-square, Normed Fit Index (Delta 1), Comparative Fit Index, and Root Mean Square Error of Approximation. Table 2 shows the goodness of fit indices for the four ethnic groups. The model fit indices indicated that all four models were accepted.

Table 2: Fit Indices of the path models for the four ethnic groups

Ethnicity	χ^2	df	χ^2/df	NFI	CFI	RMSEA
African-American	3.91	5	.782	.955	1.000	.000
Hispanic	12.87	5	2.57	.943	.959	.060
Asian-American	4.89	5	.978	.943	1.000	.000
Caucasian	52.97	5	10.60	.949	.953	.058

Note: NFI – Normed Fit Index; CFI – Comparative Fit Index; RMSEA – Root Mean Square Error of Approximation.

RESULTS

Table 3: Bivariate Correlation Coefficients of the variables in the model with Mathematics Performance; Four Ethnic Groups

Mathematics Performance	African-American	Hispanic	Asian-American	Caucasian
Mother Education	.13*	.18*	.23**	.13*
Father Education	.21**	.10*	.22**	.19*
Poverty	-.18*	-.01	-.01	-.01
Family Resource	.17*	.14*	.14*	.17*
Gender	.03	.11*	.02	.05
Self-Concept	-.29**	.12*	.08	.19*
Academic Aspiration	.16*	.16*	.06	.14*

*Note: * p<.05; ** p<.01; *** p<.001 indicating significant predictors; To compare the strengths of the associations, the statistical powers due to unbalanced sample sizes were adjusted.*

To examine the nature of the associations among the variables in the model and mathematics test score, bivariate correlation coefficients were obtained. Regarding the relationship between parent education levels and test scores, there are positive relationships between parent education and students' test scores. Specifically, the educational level of mothers has a stronger impact on test scores than the fathers' for Hispanic students, while the educational level of fathers has greater impact than the mothers' for African-American and Caucasian students. It should be noted that a disordinal interaction effect between gender of parents and ethnicity of students on mathematics performance was discovered.

The variable of poverty is significant for African-American students only. To determine the reason why a significant relationship was observed for African-American only, variability of poverty was compared. The variance of the poverty among African-American, Hispanic, Asian-American, and Caucasian are 2.00, 1.48, 1.02, and .99, respectively. Within the academically talented group of students, African-American students showed the greatest variance among four

ethnic groups. It can be reasoned that heterogeneous poverty of African-American students significantly influences their academic performance.

Consistently, family academic resource has a positive impact on academically talented students' mathematics performance across four ethnic groups. Meanwhile, a negative association between academic self-concept and mathematics performance was observed in the African-American group of students, while positive relationships were obtained from the other three ethnic groups. For general population for this ethnic group, low or medium size of association between self-concept and academic achievement were reported (Awad, 2007; Worrell, 2007). For Hispanic students only, gender has a significant relationship with mathematics, in which boys have the advantage.

Table 4: Path Model of Mathematics Performance of 8th Graders; Unstandardized Coefficients, Standard Errors, and Standardized Coefficients (African-American & Hispanic)

	African-American			Hispanic		
	b	*s.e.*	*β*	b	*s.e.*	*β*
Mother Education	-.36	2.43	-.02	1.89	1.31	.14
Father Education	3.24	2.41	-.20	-.32	1.28	-.02
Poverty	-4.54	2.31	-.23*	-2.86	1.64	-.12
Family Resource	5.09	2.55	.23*	2.86	1.92	.12
Gender	4.20	5.64	.08	8.56	3.73	.14*
Self-Concept	-12.49	5.80	-.24**	4.92	3.47	.09
Academic Aspiration	5.27	5.66	.11	6.91	3.11	.15*
R^2			.21			.09

*Note: * p<.05; ** p<.01; *** p<.001 indicating significant predictors*

Table 5: Path Model of Mathematics Performance of 8th Graders; Unstandardized Coefficients, Standard Errors, and Standardized Coefficients (Asian-American & Caucasian)

	Asian-American			Caucasian		
	b	*s.e.*	β	b	*s.e.*	β
Mother Education	2.86	3.77	.13	.15	.70	.01
Father Education	3.37	3.93	.14	2.77	.72	.13***
Poverty	-4.55	4.31	-.11	-2.49	.89	-.07**
Family Resource	3.98	3.81	.11	4.09	.83	.13***
Gender	.02	7.94	.00	3.70	1.73	.05*
Self-Concept	9.20	8.67	.10	11.70	1.54	.18***
Academic Aspiration	1.09	6.65	.02	3.95	1.29	.08**
R^2			.08			.10

*Note: * p<.05; ** p<.01; *** p<.001 indicating significant predictors; The significant probabilities in Caucasian students are associated with their large sample size.*

Tables 4 and 5 showed the path coefficients for the four ethnic groups of students. Overall values of the coefficients are similar to the bivariate correlation coefficient matrix. Because the significant probabilities in Caucasian students are related to the large sample size of the group, comparisons across four ethnic groups were based on the effect size of the coefficients. For African American students, father education, poverty, family resource, and self-confidence are significant predictors of their academic achievement. For Hispanic students, mother education, poverty, family resource, gender, and academic aspiration are significant factors. For Asian students, mother education and father education are significant predictors. Lastly, for academically talented Caucasians, father education, family resource, and academic self-concept are significant factors.

Table 6: Direct Effect and Indirect Effect on Path Model of Mathematics Performance of Academically Talented Students based on Standardized Coefficients (African-American and Hispanic)

	African-American			Hispanic		
	Direct	Indirect	Total	Direct	Indirect	Total
Mother Education	-.02	.06	.04	.14	.03	.17*
Father Education	.20	.04	.24*	-.02	-.02	-.04
Poverty	-.23	-.09	-.32**	-.12	.04	-.08
Family Resource	.23	-.04	.19	.12	-.00	.12
Gender	.08	-.03	.05	.14	-.01	.13
Self-Concept	-.24	.00	-.24*	.09	.00	.09
Academic Aspiration	.11	.00	.11	.15	.00	.15*
R^2			.21			.09

*Note: * p<.05; ** p<.01; *** p<.001 indicating significant predictors*

Table 7: Direct Effect and Indirect Effect on Path Model of Mathematics Performance of Academically Talented Students based on Standardized Coefficients (Asian-American and Caucasian)

	Asian-American			Caucasian		
	Direct	Indirect	Total	Direct	Indirect	Total
Mother Education	.13	.01	.14*	.01	.01	.02
Father Education	.14	-.02	.12*	.13	.01	.14*
Poverty	-.11	.01	-.10	-.07	.01	-.06
Family Resource	.11	.00	.11	.13	.01	.14*
Gender	.00	.00	.00	.05	.02	.07
Self-Concept	.10	.00	.10	.18	.00	.18*
Academic Aspiration	.02	.00	.02	.08	.00	.08
R^2			.08			.10

*Note: * p<.05; ** p<.01; *** p<.001 indicating significant predictors*

When the two mediating variables, such as academic self-concept and academic aspiration were considered to determine a purified effect of each exogenous variable in the path models, only African-American students demonstrated a significant effect on mathematics achievement. It should be noted that academic self-concept and academic aspiration do not have indirect effects because they are mediating variables in the model. Interestingly, the overall model fit demonstrates that the conceptual model is the most efficient (R^2= .21) for African-American students. It indicates that 21 percent of the variance of mathematics achievement of academically talented African-American students is explained by the seven predictors in the model.

CONCLUSIONS AND IMPLICATIONS

As previously hypothesized, significant relationships between parent education level, poverty, family academic support, and gender with academic self-concept or academic aspiration for academically talented students were found. However, the patterns of associations are not consistent across the four ethnic groups.

Although some interaction effect between parents' gender and ethnicity was discovered, their education levels were significant predictors for talented students' academic achievements of all four groups. Specifically, the educational level of Hispanic mothers has a stronger impact on test score than their spouses, while educational level of African American and Caucasian fathers has a greater impact than their spouses. It is recommended that further research should be performed along this line to explore feasible cultural factors for this phenomenon.

However, unlike the previous research findings (Colon & Sanchez, 2010; Gandara, 2009; Lys, 2009; Plunkett, Scott, Behnke, Sands, & Choi, 2009; Spera, Wentzel, and Matto, 2009),

poverty and gender are not significant predictors for mathematics achievement of most ethnic

student groups. It should be noted that poverty is a significant factor for only African Americans,

while gender is a significant factor for only Hispanic students. However, it is recommended to

conduct a cross-validation study with another international data. As with all correlational

analyses, there is a concern that the observed associations in this project might be attributable to

the unique sample characteristics of the TIMMS 2007. Because this study was one of the first to

use an international assessment data, there is a need to replicate this study to validate the

observed correlations in another data set.

Based on the associations from the path models, the following considerations should be

practiced for identifying academically gifted students:

1. Inconsistent patterns across the four ethnic groups indicate that diverse criteria associated with appropriate adjustments should be practiced to identify academically talented students for minority groups.

2. For African-American students, the father's education level and poverty level should be utilized as criteria to identify academically talented students.

3. For Hispanic students, the mother's education level should be employed as a criterion to identify academically talented students.

4. Poverty level should be considered in selecting academically talented African American students, while gender should be considered for academically talented Hispanic students in order to provide a balance between male and female students.

5. Promoting academic self-concept for African-American students and enhancing academic aspiration for Hispanic students should be supported to increase the concrete number of academically talented students.

However, it is important to note that it was not the intent of this paper to suggest that examining biases or inequalities in the identifying procedures are unimportant. Findings from this effort suggest that strategies to adjust the significant variables for the process will increase the effectiveness of the procedure and improve the biased situation of the minority students. In addition, this study does not advise to replace existing identification criteria used by the local educational agencies (LEAs) for the gifted and talented education (GATE). Rather, the result of this study may give an awareness of other considerations for the district administrators or teachers who are involved in indentifying academically talented students.

Academic self-concept tended to be a significant predictor of academic achievement for African-Americans and Caucasians, but not for Hispanics and Asian Americans. Future researchers may consider performing a study for the association between academic self-concept and academic achievement and its inconsistent pattern between nonimmigrant and immigrant students. As a final remark, the extent of this research and its application should not only be limited to California's gifted educational program but rather to the entire gifted education system in the United States.

REFERENCES

Adams, S. K., Kuhn, J., & Rhodes, J. (2006). Self-Esteem Changes in the Middle School Years: A Study of Ethnic and Gender Groups. *RMLE Online: Research in Middle Level Education, 29*(6), 1-9.

Arbuckle, J. L. (1996). Full information estimation in the presence of incomplete data. In G. A. Marcoulides & R. E. Schumacker (Eds.), Advanced structural equation modeling: Issues and techniques (pp. 243-277). Mahwah, NJ: Lawrence Erlbaum Associates.

Awad, G. H. (2007). The Role of Racial Identity, Academic Self-Concept, and Self-Esteem in the Prediction of Academic Outcomes for African American Students. *Journal of Black Psychology, 33*(2), 188-207.

Bonner, F. A., & Jennings, M. (2007). Never too young to lead: Gifted African American males in elementary school. *Gifted Child Today, 30*(2), 30-36.

Byrne, B. M. (2001). Structural equation modeling with AMOS: Basic concepts, applications, and programming. Mahwah, NJ: Lawrence Erlbaum Associates.

Callahan, C. M. (2005). Identifying gifted students from underrepresented populations. *Theory Into Practice, 44*(2), 98-104.

Chavkin, N. F., Gonzalez, J. (2000). *Mexican Immigrant Youth and Resiliency: Research and Promising Programs.* (ERIC Document Reproduction Service No. ED 447 990)

Ford, D. Y. & Grantham, T. C. (2003). Providing access for culturally diverse gifted students: From deficit to dynamic thinking. *Theory into Practice, 42*(3), 217-225.

Grantham, T. C. (2004). Multicultural mentoring to increase Black male representation in gifted programs. *Gifted Child Quarterly, 48*(3), 232-246.

Hassinger, M., Plourde, L. A. (2005). "Beating the Odds": How Bi-Lingual Hispanic Youth Work through Adversity to Become High Achieving Students. *Education, 126*(2), 316-327.

Henry, C. S., Merten, M. J., Plunkett, S. W., & Sands, T. (2008). Neighborhood, parenting, and adolescent factors and academic achievement in Latino adolescents from immigrant families. *Family Relations*, *57*(5), 579-590.

Hertzog, N. B. (2005). Equity and access: Creating general education classrooms responsive to potential giftedness. *Journal for the Education of the Gifted, 29*(2), 213-257.

Jarvis, J. M. (2009). Planning to unmask potential through responsive curriculum: The "Famous Five" exercise. *Roeper Review, 31*(4), 234-241.

Lee, S., Matthews, M. S., & Olszewski-Kubilius, P. (2008). A national picture of talent search and talent search educational programs. Gifted Child Quarterly, 52(1), 55-69.

Mattai, P. R., Wagle, A. T., & Williams, J. M. (2010). An often-neglected issue in consideration of gifted African American millennial students: Implications for school planning and policy. *Gifted Child Today, 33*(2), 26-31.

McBee, M. T. (2006). A descriptive analysis of referral sources for gifted identification screeing by race and socioeconomic status. *Journal of Secondary Gifted Education, 17*(2), 103-111.

Mikk, J. (2005). *Economic and Educational Correlates of TIMSS Results*. (ERIC Document Reproduction Service No. ED 493 518).

Miller, L. S. (2004). *Promoting sustained Growth in the Representation of African Americans, Latinos, and Native Americans among Top Students in the United States at All Levels of the Education System*. (ERIC Document Reproduction Service No. ED 485 166)

Moore, J. L., Ford, D. Y., & Milner, H. R. (2005). Recruitment is not enough: Retaining African American students in gifted education. *Gifted Child Quarterly, 49*(1), 51-67.

National Assessment of Educational Progress (2008). *A Profile of State Assessment Standards.* Retrieved March 31, 2008 from http://nces.ed.gov/nationsreportcard/researchcenter/profile_standards.asp.

Nebbitt, V. (2009). Self-Efficacy in African American Adolescent Males Living in Urban Public Housing. *Journal of Black Psychology, 35*(3), 295-316.

Nichols, T. M., Kotchick, B. A., Barry, C. M., Haskins, D. G. (2010). Understanding the Educational Aspirations of African American Adolescents: Child, Family, and Community Factors. *Journal of Black Psychology, 36*(1), 25-48.

Park, H. (2008). The impact of technology use on Hispanic students' mathematics achievement within family and school contexts: subgroup analysis between English and non-English speaking students. *Journal of Educational Computing Research, 38*(4), 553-568.

Parris, G. P., Owens, D., Johnson, T., Grbevski, S., Holbert-Quince, J. (2010). Addressing the career development needs of high-achieving African American high school students: Implications for counselors. *Journal for the Education of the Gifted, 33*(3), 417-436.

Spera, C., Wentzel, K. R., & Matto, H. C. (2009). Parental aspirations for their children's educational attainment: Relations to ethnicity, parental education, children's academic performance, and parental perceptions of school climate. *Journal of Youth and Adolescence, 38*(8), 1140-1152.

Whiting, G. W. (2006). Enhancing culturally diverse males' scholar identity: Sugestions for educators of gifted students. *Gifted Child Today, 29*(3), 46-50.

Worrell, F. C. (2007). Ethnic identity, academic achievement, and global self-concept in four groups of academically talented adolescents. *Gifted Child Quarterly*, *51*(1), 23-38.