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Effects of Students' Mathematics Attitudes and Behaviors on Mathematics Achievement

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Abstract. This study examined the hypothesized linkages among high school students' math attitudes and behaviors to mathematics achievement using nationally representative sample of 14,713 10th grade students who attended 751 high schools in 2002. After controlling for individual background variables and parental involvement, math self-concept and math affection had significant effect on students' math achievement.

Keywords: Math affection, Math self-concept, Mathematics Achievement.

1. Introduction

This study utilized data from the Education Longitudinal Study (ELS), a national longitudinal study of 16,373 high school sophomores who were enrolled in a national sample of 751 U.S. high schools in 2002. In the 2002 base year, ELS researchers tested high school sophomores' achievement in reading and math and gathered information about their attitudes and experiences. These same students were surveyed and tested again two years later in 2004, when they were high school seniors. High school transcripts were collected in the spring of 2005 for most of the original students. Information was obtained from students and their school records, as well as their parents, teachers, and administrators of their high school, including the principal and library media center director. Data for the present study was drawn from the sample of 14,713 10th grade students who attended 751 public and private high schools in 2002 and for whom were resurveyed in 2004 and transcripts were collected.

2. Method

The data were used to construct a comprehensive set of individual-level and school-level variables to measure their effects on advanced mathematics course-taking patterns. These variables are selected based on the literature on predictors of student academic achievement and school effectiveness[1, 2].

At the student level, four types of variables were constructed. The first type represents demographic characteristics of students (e.g., gender and ethnicity). The second type represents family background variables. Two types of family background measures were constructed. The first type represents the structural variables: socioeconomic status, which is a composite measure developed by NCES based on father's education level, mother's education level, father's occupation, mother's occupation, and family income, and dummy variables indicating student does not live with both biological parents, and non-English-speaking households. The second type of family background variables represents various dimensions of family practices.

The third type of variables represents students' academic background variables, which included academic performance and a dummy variable indicating if a student is in a college preparatory program or not. Academic performance was measured by standardized test score in 10th grade math. The fourth type of variables represents students' attitudes and behaviors which included students' college aspiration, attitudes towards mathematics, and student engagement. Factor analyses showed that there are three unique components of student engagement that identified the extent to which; (1) student coming to class on time and homework done which has both been referred to as behavioral engagement, (2) students feel classes are interesting and challenging which has both been referred to as emotional engagement, (3) students put forth best effort when studying which has been referred to as academic engagement. Attitudes towards mathematics include two

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composite factors that measure students' reports on their competency in mathematics, and students' reports about whether they think math is fun.

Outcome variable. Course-taking patterns in mathematics are measured using an ordinal composite variable (F1RMAPIP). This measure indicates the highest level of mathematics for which the student received non-zero credit while in high school. For this study, the eight levels of F1RMAPIP were collapsed into four to report the highest level of mathematics taken in high school: (1) no advanced mathematics course-taken; (2) advanced mathematics I; (3) advanced mathematics II; and (4) advanced mathematics III.

3. Results

3.1. Predictors of Advanced Mathematics Course-taking Patterns

First model included individual demographic predictors: gender and ethnicity. This model confirmed the earlier descriptive results. Specifically, the odds of taking advanced mathematics level 1 and 2 were 30% higher for female students than for male students; the odds of taking advanced math level 3 were three times higher for Asians than for Whites; the odds of taking advanced math level 1, 2, and 3 were much lower for Blacks, Hispanics, and Native Americans than for Whites. The next model added a series of family background variables. Students from high SES family were much more likely to take advanced mathematics across all levels than students from low SES families. Students not living with both parents were less likely to take advanced mathematics across all levels than students living with both parents. Controlling family background variables in the model also reduced the effect of the predictor for Black and for Hispanic groups. This suggests that the lower rates of taking advanced math courses for Blacks and Hispanics can be explained, in part, by differences in their family backgrounds.

The third model added parental involvement factors. When controlling for SES and other family background variables, many of the parental involvement factors (especially, communication, participation, and expectation) were significant predictors of advanced mathematics courses-taking . The fourth model added students' academic background variables. Controlling for other variables in the model, the odds of taking advanced mathematics courses were much higher for students with high academic backgrounds. The final model examined the effects of students' math attitudes and behaviors, which included students' college aspiration, attitudes towards mathematics, and student engagement. Three factors of student engagement were significant predictors of advanced mathematics courses-taking. Mathematics self-concept and attitude had a significant effect on whether students took advanced mathematics. Controlling for other variables in the model, students' college aspiration and academic background had powerful effects on advanced mathematics courses-taking.

3.2. Limitations

Data examined in this study were collected from student self-report. The students' perceptions of parent-child relationships are likely to differ from parents' perceptions. Although, previous research indicates that compared with parent-reported parental social capital, students' perception of parental social capital had a higher association with academic achievement [3,4], the disparity may reflect a lack of communication or rapport between parents and children. Thus, it would have been beneficial to include the corroborative information from students' perceptions, parental perceptions, and other sources of information such as diary data or observation. Another limitation in this study is that gender differences in the relations between parental social capital and math achievement emerge during the middle grades. To be certain of the gender differences between parental social capital and math achievement, and its relative importance, nationally representative longitudinal data is needed measuring students from the middle grades on, when the pool of math talent is formed [5].

4. Acknowledgement

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5. References

[1] Lee, V.E., Smith, J.B., & Croninger, R.G. (1997). How high school organization influences the equitable distribution of learning in mathematics and science. *Sociology of Education, 70,* 128-150.

[2] Rumberger, R., & Thomas, S.L. (2000). The distribution of dropout and turnover rates among urban and suburban high schools. *Sociology of Education, 73(1),* 39-67.

[3] Desimone, L. (1999). Linking parent involvement with student achievement: Do race and income matter? *The Journal of Educational Research, 93*, 11-30.

[4] Paulson, S.E. (1994). Relations of parenting style and paternal involvement with ninth grade students' achievement. Journal of Early Adolescence, 14, 250-267.

[5] Catsambis, S. (1994). The path to math: Gender and racial-ethnic differences in mathematics participation from middle school to high school. *Sociology of Education, 67(3),* 199-215.