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Academic Achievement Differences by Student Mobility: An Analysis of Texas Grade 8 Student Performance

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Academic Achievement Differences by Student Mobility: An Analysis of Texas Grade 8 Student Performance

Benjamin Mark Bostick [α] & John R. Slate [σ]

Abstract- Differences in reading, mathematics, and science achievement of Grade 8 students as a function of mobility were examined with and without controls for economic status in this investigation. Data were obtained from the Texas Education Agency Public Education Information Management System for the 2003-2004 through the 2007-2008 school years. Statistically significant differences were revealed in reading, mathematics, and science test scores as a function of student mobility, both when controlling for and not controlling for economic status. Mobile students had statistically significantly lower reading and mathematics test scores than did non-mobile students for all 6 school years. Science scores were statistically significantly lower for all three years for which data were available. Implications for policy and practice and suggestions for future research were made.

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I. Introduction

Grade 8 has been the point of transition between high schools and primary schools in the United States since the beginning of urban public education. Encouraged through reform movements during the late 1800s and 1900s, school systems were transitioned to provide students the more rigorous course work of high school earlier. These developments coupled with overcrowding and reforms requiring or encouraging more students to obtain a high school education provoked the creation of Grade 7 to Grade 9 junior high schools. From the 1960s through the 1990s middle school grade configurations (i.e., Grade 6 to Grade 8 or Grade 6 to Grade 9) replaced junior high schools (Clark, Slate, Combs, & Moore, 2014). During the 2013-2014 school year, 379,597 students were enrolled in Grade 8 in Texas. During the same school year, over 67% of campuses serving Grade 8 students ended with Grade 8 (Texas Education Agency, 2014). The predominance of Grade 8 as a gateway grade to high school makes understanding influences on Grade 8 students' academic achievement a high priority.

II. Student Effects of Mobility

Mobility has been indicated as at least a contributing factor to negative academic outcomes (Kerbow, 1995; Lee & Smith, 1999; Rhodes, 2007; Rumberger, Larson, Ream, & Plardy, 1999; Smith, Smith, & Byrk, 1998). Mobile students constantly entering and leaving classrooms have been reported to reduce the pace of the curriculum. These curricular pacing issues, if not addressed, can create difficulties both for mobile and non-mobile students (Rumberger et al., 1999; Thompson, Meyers, & Oshima, 2011). Researchers analyzing the effects of mobility on students have also linked mobility to negative behavior (e.g., Fomby & Senott, 2013; Haynie, South, & Bose, 2006; Simpson & Fowler, 1994) and poor school persistence (e.g., Rumberger & Larson, 1998; South, Haynie, & Bose, 2007). Mobile students also participate in extracurricular activities at a lower rate, according to Scherrer (2013), which has been shown to increase academic achievement, reduce negative behavior, and increase connections to school.

Differential effects of mobility have been documented depending on other characteristics of students. Mobile students with high academic achievement exhibit reduced achievement; however, students who are able to become involved in extra-curricular activities do not experience the decrease in achievement. Students with poor academic achievement at the school they are leaving often see similar results at their new school. Average students tend to experience the greatest reduction in performance when entering a new school (Langenkamp, 2011). It is also possible that the cause of mobility creates differences in student outcomes (Hanushek, Kain, & Rivkin, 2004, 2009).

III. Causes and Prevalence of Mobility

Families in the United States move for a variety of reasons (Ream, 2005; Rumberger, 2003). In Texas during the 2012-2013 school year, over 875,000 students were classified as mobile by Texas Education Agency's (2014) definition (i.e., attended a particular school for less than 83% of the school year). This number includes residential mobility, school encouraged mobility, and parent/student choice mobility. In the United States, Rumberger, (2003) reported that 58% of student mobility is due to residential mobility and 10% is due to school encouraged moves (e.g., expulsion, or placement at an alternative school). Whether the cause

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is parent and student choice, school encouraged, or residential, mobility is related to negative school outcomes (Gruman, Harachi, Abbott, Catalano, & Fleming, 2008; Rumberger, 2003).

Mobility to seek out a better school is a type of parent or student choice caused mobility. However, Hanushek et al. (2004, 2009) illustrated that school improvement only occurred when changing districts. School choice not combined with a residence change is regularly only allowed within a district. School encouraged moves, generally associated with poor behavior, may be initiated with the intention of eliminating problems, but may have negative long term effects (Fomby & Sennott, 2013). Residential mobility sometimes is able to be delayed and sometimes not able to be delayed. In situations where mobility is unavoidable some schools have instituted policies and procedures to mitigate the negative effects of mobility. Other schools have instituted programs to discourage mobility (Rumberger; 2003) in some ways extending homeless students supports to mobile students. Both approaches to solutions for mobility have been shown to be successful.

IV. Solutions for Mobility

Residential mobility that is unavoidable is a regular occurrence in the military community. The Department of Defense Education Activity, which administers schools on military bases, has developed several programs designed to alleviate the known negative effects of mobility (Smearkar & Owens, 2003). School districts in areas where mobility is also common have also instituted similar programs, as well as programs to discourage mobility when possible (Franke, Isken, & Para, 2003). Policies and programs can and have been implemented to assist populations known to experience high mobility (Branz-Spall, Rosenthal, & Wright, 2003; Rhodes, 2007).

The Department of Defense Education Activity administers schools on U.S. military bases around the world. As military connected families are transferred from base to base, often their children are subjected to unavoidable residential mobility mid-school year (Smearkar & Owens, 2003). As a result of this frequent mobility, these schools have adapted several best practices for mitigating the negative effects of student mobility. Schools on all military bases maintain an aligned curriculum so that students transferring midyear do not experience any larger gaps than necessary (Smearkar & Owens, 2003). Records transfer is expedited to ensure students can be immediately placed in appropriate programs. This student information is also shared with off base schools in the area where military connected families may also reside. Department of Defense Education Activity schools maintain a small size and experienced staff to meet students' needs more appropriately. Students already attending the schools are also used as ambassadors to incoming students to assist in social acclimation at the new school (Smearkar & Owens, 2003; Summers & Moehnke, 2006).

Where military mobility is unavoidable, other residential mobility may be either avoidable or possibly delayed until summer break. Schools where student mobility has been identified as an issue have instituted programs to inform parents of the negative effects of mid-school year mobility (Franke et al., 2003). Programs providing access to medical services, summer nutrition, and summer activities foster a greater connection to schools. Families who feel a stronger connection to their school are more likely to avoid a move if possible (Franke et al., 2003). School districts with identified mobility issues have implemented policies allowing students to attend the school they began the year in even if a residential change has occurred that would otherwise require a school change. Some districts have included transportation provisions in their policies to increase the attractiveness of staying at one school for an entire year despite a residence change (James & Lopez, 2003).

Federal and state policies have been implemented to assist mobile students as well. The McKinney-Vento Homeless Education Improvements Assistance Act of 2001 requires schools to allow students experiencing homelessness to remain in the school they began the school year in, or attend a school even if they do not have permanent residence within that school's established attendance zone (Julianelle & Foscarinis, 2003; Pavlakas, 2014). Federal programs have also provided funds for technology to assist migrant students in receiving a continuous educational experience during their mobility (Branz-Spall et al., 2003).

V. Purpose of the Study

The purpose of this study was to investigate the connection between student mobility (i.e., enrollment in a particular school less than 83% of the school year) and academic achievement (i.e., Texas Assessment of Knowledge and Skills raw scores) for Grade 8 students in Texas while controlling for economic status. Economic status was measured by eligibility for the federal free and reduced lunch program. Six years of Texas statewide data were analyzed for reading and mathematics and three years of data were analyzed for science to ascertain the degree to which trends might be present in student performance.

VI. Significance of the Study

Researchers (e.g., Heinlein & Shinn, 2000; Kain & O'Brien, 1998) who have considered the effects of mobility have not generated a clear consensus on the effects of mobility when controlling for other variables. The differences in the outcomes of research efforts are contributed to by difficulty in obtaining samples large enough to produce statistical significance or data sources rich enough to include information regarding confounding variables. Data utilized in this study were obtained from the Texas Education Agency Public Education Information Management System. This data source contained information for all students who took the Texas Assessment of Knowledge and Skills Reading, Mathematics, and Science tests in Grade 8 in Texas from school year 2002-2003 to school year 2007-2008. Data regarding student economic status were also available through this data source.

VII. Statement of the Problem

Mobility is measured in different ways throughout the research base. The lack of consistency in defining mobility along with the difficulty of tracking mobile students outside of a local education agency contributes to lack of consensus on the effects of mobility. Consistently, however, mobility is linked to negative school outcomes (Haynie et al., 2006; Kerbow, 1995; Rumberger, 2003; Simpson & Fowler, 1994). For the purposes of this study, the definition of mobility by the Texas Education Agency (2012) was used: a student's enrollment in one school for less than 83% of the school year. Negative school outcomes, regardless of the definition used, may have been related to inconsistency in curriculum between the sending and receiving school (Smith, Fein, & Paine, 2008). Students selecting new peer groups contribute to negative social behaviors after a move (Haynie et al., 2006). Changing schools could have also caused difficulty for students creating connections to their new school (Kerbow, Azcoita, & Buell, 2003).

These various difficulties may have either been the cause or effect of mobility. Researchers (e.g., Heinlein & Shinn, 2000) who have undertaken studies regarding mobility have often utilized sample sizes that are not adequate to identify confounding variables and large enough to produce statistical significance. Data collected for this study provided a sufficiently large sample size such that the issues of power and confounding variables (i.e., prior academic achievement, and economic status) were addressed.

VIII. Research Questions

The research questions addressed in this study were organized according to the three subjects assessed in Texas at Grade 8. The research questions concerning reading were: (a) What is the relationship of student mobility to Grade 8 reading achievement when controlling for economic status?; and (b) What is the relationship of student mobility to Grade 8 reading achievement when not controlling for economic status? Research questions regarding mathematics were: (a) What is the relationship of student mobility to Grade 8 mathematics achievement when controlling for economic status?; and (b) What is the relationship of student mobility to Grade 8 mathematics achievement when not controlling for economic status? Research questions involving science were: (a) What is the relationship of student mobility to Grade 8 science achievement when controlling for economic status?; and (b) What is the relationship of student mobility to Grade 8 science achievement when not controlling for economic status? These research questions were repeated for each school year of data analyzed.

IX. Method

a) *Research Design*

A non-experimental research design (Johnson & Christensen, 2008) was used for this study because of the use of archival data. The independent variable, mobility, had already occurred; therefore random group assignment was not possible. The independent variable of mobility as defined by the Texas Education Agency (i.e., enrollment in a particular school for less than 83% of the school year) was used as a control variable for three dependent variables in this study. The dependent variables in this study were represented by three measures of academic achievement (i.e., reading, mathematics, and science) assessed in Grade 8 in Texas. Achievement levels in each of these areas were measured by the raw score on the respective Grade 8 subject area subtest of the Texas Assessment of Knowledge and Skills. Student economic status, measured by eligibility for the federal free and reduced lunch program, was utilized as a control variable.

b) *Participants and Instrumentation*

In this study data from the Texas Education Agency Public Education Information Management System were analyzed to investigate differences in the academic achievement of mobile and non-mobile students in Grade 8 in Texas. All students who took the Texas Assessment of Knowledge and Skills Reading, or Mathematics test in Grade 8 in school years 2002-2003 to 2007-2008 and students who took the Science assessment in Grade 8 in the 2005-2006 school year, Grade 8 in the 2006-2007 school year, Grade 8 in the 2007-2008 school year were included in this study. These groups of students included over 300,000 students for each school year.

Raw scores for the Grade 8 Texas Assessment of Knowledge and Skills tests administered in 2003, 2004, 2005, 2006, 2007, and 2008 were utilized as the dependent variables. Readers can review specific score validity and score reliability data in the specific technical manuals available through a Public Information Request to the Texas Education Agency.

c) Data Analysis

Research questions in which economic status (i.e., the a research question) were controlled for were analyzed using Multivariate Analysis of Covariance (MANCOVA) statistical procedures. Prior to conducting any MANCOVA procedures, its underlying assumptions of data normality and homogeneity of covariance were determined. An underlying assumption of homogeneity of regression slopes also had to be checked prior to considering the MANCOVA analysis.

Research questions in which economic status (i.e., the b research question) were not controlled for were analyzed using a Multivariate Analysis of Variance (MANOVA) statistical procedure. A MANOVA procedure was used due to the multiple dependent variables associated with a single independent variable. The MANOVA procedure has similar underlying assumptions to the MANCOVA procedures. Even if these assumptions were not met, MANOVA procedures are robust enough to provide useful data (Field, 2009).

X. Results

Results of the statistical analysis for Grade 8 mobile and non-mobile students will be reported by TAKS subject area subtest (i.e., Reading, Mathematics, and Science in years available). Results of each test will be reported in chronological order. Research question a for each subject area required a MANCOVA procedure to consider economic status as a covariate and are reported first. Research question b for each subject area required a MANOVA procedure and are discussed second. Data from the TAKS Reading and Mathematics tests for the 2002-2003 through the 2007-2008 school years and the TAKS Science test for the 2005-2006 to 2007-2008 school years were analyzed.

As noted previously, student economic status was used as a covariate in research question a for each subject area. For these research questions, a MANCOVA statistical procedure was calculated for the 2002-2003 school year. A statistically significant difference was yielded on student overall achievement, Wilks' $\Lambda = 1.0$, $p < .001$, partial $\eta^2 = .002$, trivial effect size, as a function of student mobility, and as a function of student poverty, Wilks' $\Lambda = .86$, $p < .001$, partial $\eta^2 = .14$, large effect size (Cohen, 1988). Readers should note the strong influence of poverty on student achievement in this analysis. A statistically significant difference was present between the covariate of economic status and TAKS Reading scores, $F(1, 217514) = 2608.54$, $p < .001$, $r = .33$; and between the covariate of economic status and TAKS Mathematics scores, $F(1, 217514) = 29944.78$, $p < .001$, $r = .35$. After controlling for the effect of economic status, a statistically significant effect of mobility was present for the TAKS Reading scores, $F(1, 217514) = 308.01$, $p < .001$, partial $\eta^2 = .001$ and TAKS Mathematics scores, $F(1, 217514) = 355.64$, $p < .001$, partial $\eta^2 = .002$.

The MANOVA completed for research question b for each subject area revealed a statistically significant difference between mobile and non-mobile Grade 7 students in their overall achievement, Wilks' $\Lambda = 1.0$, $p < .001$, partial $\eta^2 = .003$, trivial effect size (Cohen, 1988). Follow-up Analysis of Variance (ANOVA) procedures also yielded statistically significant differences between mobile and non-mobile Grade 8 students in their TAKS Reading performance, $F(1, 218067) = 494.63$, $p < .001$, partial $\eta^2 = .002$ and in their TAKS Mathematics performance, $F(1, 218067) = 563.02$, $p < .001$, partial $\eta^2 = .003$.

Non-mobile students had higher average TAKS Reading and Mathematics test scores in the 2002-2003 school year than their mobile counterparts. These results remained even when controlling for economic status. Cohen's *d* indicated a small effect size for both reading (i.e., 0.31) and mathematics (i.e., 0.35; Cohen, 1988). The average TAKS Reading test raw score for mobile students was 2.55 points lower than the average TAKS Reading test raw score for non-mobile students. With respect to the TAKS Mathematics exam, the average raw score for mobile students was 3.23 points lower than the average raw score for non-mobile students. Delineated in Table 1 are the descriptive statistics for Grade 7 TAKS Reading, and Mathematics scores by mobility and economic status for the 2002-2003 school year.

Table 1: Descriptive Statistics for Grade 8TAKS Reading and Mathematics Tests for Mobile and Non-Mobile Students for the 2002-2003 School Year

TAKS Test by Mobility Status	n	M	SD
Non Mobile	213,425		
Mobile	4,642	36.59	8.92
Mathematics			
Non-Mobile	213,425	30.95	9.18
Mobile	4,642	27.72	9.04

As noted previously, student economic status was used as a covariate in research question a for each subject area for the 2003-2004 school year. For these research questions, a MANCOVA statistical procedure was calculated. A statistically significant difference was yielded on student overall achievement, Wilks' $\Lambda = 1.0$,

$p < .001$, partial $\eta^2 = .003$, trivial effect size, as a function of student mobility, and as a function of student poverty, Wilks' $\Lambda = .86$, $p < .001$, partial $\eta^2 = .14$, large effect size (Cohen, 1988). Similar to the previous year, poverty had a large influence on student achievement. A statistically significant difference was present between the covariate of economic status and TAKS Reading scores, $F(1, 227868) = 29078.16$, $p < .001$, $r = .34$; and TAKS Mathematics scores, $F(1, 227868) = 31168.64$, $p < .001$, $r = .35$. After controlling for the effect of economic status, a statistically significant effect of mobility was still present for TAKS Reading scores, $F(1,227868) = 477.67$, $p < .001$, partial $\eta^2 = .002$ and for TAKS Mathematics scores, $F(1, 227868) = 741.80$, $p < .001$, partial $\eta^2 = .003$.

With respect to research question b for each subject area, the MANOVA revealed a statistically significant difference between mobile and non-mobile Grade 8 students in their overall achievement, Wilks' $\Lambda = 1.0$, $p < .001$, partial $\eta^2 = .005$, trivial effect size (Cohen, 1988). Follow-up ANOVA procedures also yielded statistically significant differences between mobile and non-mobile Grade 8 students in their TAKS Reading performance, $F(1, 227875) = 838.28$, $p < .001$, partial $\eta^2 = .004$ and in their TAKS Mathematics performance, $F(1, 227875) = 1169.33$, $p < .001$, partial $\eta^2 = .005$.

Similar to the previous year, non-mobile students had higher average TAKS Reading and Mathematics test scores in 2004 than their mobile counterparts. These results remained even when controlling for economic status. Cohen's *d* indicated a small effect size for both reading (i.e., 0.38) and mathematics (i.e., 0.49; Cohen, 1988). The average TAKS Reading test raw score for mobile students was 2.69 points lower than the average TAKS Reading test raw score for non-mobile students. Regarding the TAKS Mathematics exam, the average raw score for mobile students was 4.84 points lower than the average raw score for non-mobile students. Delineated in Table 2 are the descriptive statistics for Grade 8 TAKS Reading and Mathematics scores by mobility and economic status for the 2003-2004 school year.

Table 2: Descriptive Statistics for Grade 8TAKS Reading and Mathematics Tests for Mobile and Non-Mobile Students for the 2003-2004 School Year

TAKS Test by Mobility Status	n	M	SD
Reading			
Non-Mobile	222,885	39.80	6.46
Mobile	4,983	37.11	7.71
Mathematics			
Non-Mobile	222,885	33.10	9.90
Mobile	4,983	28.26	9.81

Concerning the 2004-2005 school year, student economic status was used as a covariate in research questions a for each subject area. For these research questions, a MANCOVA statistical procedure was calculated. A statistically significant difference was yielded on student overall achievement, Wilks' $\Lambda = 1.0$, $p < .001$, partial $\eta^2 = .004$, trivial effect size, as a function of student mobility, and as a function of student poverty, Wilks' $\Lambda = .86$, $p < .001$, partial $\eta^2 = .14$, large effect size (Cohen, 1988). Congruent with the previous two years, poverty had a large influence on student achievement. A statistically significant difference was present between the covariate of economic status and TAKS Reading scores, $F(1, 231858) = 297030.58$, $p < .001$, $r = .34$; and for TAKS Mathematics scores, $F(1, 231858) = 31237.98$, $p < .001$, $r = .35$. After controlling for the effect of economic status, a statistically significant effect of mobility was present for the TAKS reading scores, $F(1, 231858) = 704.44$, $p < .001$, partial $\eta^2 = .003$ and for TAKS Mathematics scores, $F(1, 231858) = 785.42$, $p < .001$, partial $\eta^2 = .003$.

For research question b for each subject area, the MANOVA revealed a statistically significant difference between mobile and non-mobile Grade 8 students in their overall achievement, Wilks' $\Lambda = 0.99$, $p < .001$, partial $\eta^2 = .006$, trivial effect size (Cohen, 1988).. Follow-up ANOVA procedures also yielded statistically significant differences between mobile and non-mobile Grade 8 students in their TAKS Reading performance, $F(1, 231982) = 1052.44$, $p < .001$, partial $\eta^2 = .005$ and in their TAKS Mathematics performance, $F(1, 231982) = 1149.79$, $p < .001$, partial $\eta^2 = .005$.

Similar to the two previous years, non-mobile students had higher average TAKS Reading and Mathematics test scores in the 2004-2005 school year than their mobile counterparts. These results remained even when controlling for economic status. Cohen's *d* indicated a small effect size for both reading (i.e., 0.40) and mathematics (i.e., 0.48; Cohen, 1988). The average TAKS Reading test raw score for mobile students was 3.45 points lower than the average TAKS Reading test raw score for non-mobile students. Concerning the TAKS Mathematics exam, the average raw score for mobile students was 4.72 points lower than the average raw score for non-mobile students. Revealed in Table 3 are the descriptive statistics for Grade 8 TAKS Reading and Mathematics scores by mobility and economic status for the 2004-2005 school year.

Table 3: Descriptive Statistics for Grade 8TAKS Reading and Mathematics Tests for Mobile and Non-Mobile Students for the 2004-2005 School Year

TAKS Test by Mobility Status	n	M	SD
Reading			
Non-Mobile	226,767	40.71	7.50
Mobile	5,091	37.26	9.46
Mathematics			
Non-Mobile	226,767	33.02	9.86
	5,091	28.30	10.09

With respect to research question a for each subject area for the 2005-2006 school year, as noted previously, student economic status was used as a covariate in research questions a for each subject area. For these research questions, a MANCOVA statistical procedure was calculated. A statistically significant difference was yielded on student overall achievement, Wilks' $\Lambda = 0.99$, $p < .001$, partial $\eta^2 = .006$, trivial effect size, as a function of student mobility, and as a function of student poverty, Wilks' $\Lambda = .83$, $p < .001$, partial $\eta^2 = .17$, large effect size (Cohen, 1988). Congruent with the previous three years, poverty had a large influence on student achievement. A statistically significant difference was present between the covariate of economic status and TAKS Reading scores, $F(1, 234319) = 30150.94$, $p < .001$, $r = .34$; TAKS Mathematics scores, $F(1, 234319) = 29978.00$, $p < .001$, $r = .35$; and TAKS Science scores, $F(1, 234319) = 45825.16$, $p < .001$, $r = .41$. After controlling for the effect of economic status, a statistically significant effect of mobility remained for the TAKS Reading scores, $F(1, 234319) = 842.44$, $p < .001$, partial $\eta^2 = .004$; TAKS Mathematics scores, $F(1, 234319) = 1275.42$, $p < .001$, partial $\eta^2 = .005$; and for the TAKS Science scores, $F(1, 234319) = 978.98$, $p < .001$, partial $\eta^2 = .004$.

For research question b for each subject area, the MANOVA revealed a statistically significant difference between mobile and non-mobile Grade 8 students in their overall achievement, Wilks' $\Lambda = .99$, $p < .001$, partial $\eta^2 = .008$, trivial effect size (Cohen, 1988). Follow-up ANOVA procedures also yielded statistically significant differences between mobile and non-mobile Grade 8 students in their TAKS Reading performance, $F(1, 234325) = 1266.28$, $p < .001$, partial $\eta^2 = .005$; in their TAKS Mathematics performance, $F(1, 234325) = 1760.66$, $p < .001$, partial $\eta^2 = .007$; and in their TAKS Science performance, $F(1, 234325) = 1486.38$, $p < .001$, partial $\eta^2 = .006$.

Similar to the previous three years, non-mobile students had higher average TAKS Reading and Mathematics scores, and also TAKS Science test scores in the 2005-2006 school year than their mobile counterparts. These results remained even when controlling for economic status. Cohen's *d* indicated a small effect size for reading (i.e., 0.44) and a moderate effect size for mathematics (i.e., 0.68) and science (i.e., 0.54; Cohen, 1988). The average TAKS Reading test raw score for mobile students was 3.69 points lower than the average TAKS Reading test raw score for non-mobile students. Regarding the TAKS Mathematics exam, the average raw score for mobile students was 5.63 points lower than the average raw score for non-mobile students. Concerning the TAKS Science exam, the average raw score for mobile students was 5.02 points lower than the average raw score for non-mobile students. Revealed in Table 4 are the descriptive statistics for Grade 8 TAKS Reading, Mathematics, Science scores by mobility and economic status for the 2005-2006 school year.

Table 4: Descriptive Statistics for Grade 8TAKS Reading, Mathematics, and Science Tests for Mobile and Non-Mobile Students for the 2005-2006 School Year

TAKS Test by Mobility Status	n	M	SD
Reading			
Non-Mobile	229,190	40.65	7.31
Mobile	5,129	36.96	9.17
Mathematics			
Non-Mobile	229,190	33.02	9.86
Mobile	5,129	28.30	10.09
Science			
Non-Mobile	229,190	33.02	9.22
Mobile	5,129	28.00	9.46

Regarding the 2006-2007 school year, as noted previously, student economic status was used as a covariate in research question a for each subject area. For these research questions, a MANCOVA statistical procedure was calculated. A statistically significant difference was yielded on student overall achievement, Wilks' $\Lambda = 1.0$, $p < .001$, partial $\eta^2 = .005$, trivial effect size, as a function of student mobility, and as a function of student poverty, Wilks' $\Lambda = .84$, $p < .001$, partial $\eta^2 = .17$, large effect size (Cohen, 1988). Congruent with the previous four years, poverty had a large influence on student achievement. A statistically significant difference was present between the covariate of economic status and TAKS Reading scores, $F(1, 237335) = 26235.44$, $p < .001$, $r = .32$; TAKS Mathematics scores, $F(1, 237335) = 28061.39$, $p < .001$, $r = .33$; and TAKS Science scores, $F(1, 237335) = 45999.49$, $p < .001$, $r = .41$. After controlling for the effect of economic status, a statistically significant effect of mobility was present for the TAKS Reading scores, $F(1, 237355) = 555.82$, $p < .001$, partial $\eta^2 = .002$; TAKS Mathematics scores, $F(1, 237355 = 1149.29$, $p < .001$, partial $\eta^2 = .005$; and TAKS Science scores, $F(1, 237335) = 893.47$, $p < .001$, partial $\eta^2 = .004$.

For research question b for each subject area, the MANOVA revealed a statistically significant difference between mobile and non-mobile Grade 8 students in their overall achievement, Wilks' $\Lambda = 0.99$, $p < .001$, partial $\eta^2 = .007$, trivial effect size. Follow-up ANOVA procedures also yielded statistically significant differences between mobile and non-mobile Grade 8 students in their TAKS Reading performance, $F(1, 237408) = 854.11$, $p < .001$, partial $\eta^2 = .004$; in their TAKS Mathematics performance, $F(1, 237408) = 1532.79$, $p < .001$, partial $\eta^2 = .006$; and in their TAKS Science performance, $F(1, 237408) = 1302.04$, $p < .001$, partial $\eta^2 = .005$.

Similar to the previous four years, non-mobile students had higher average TAKS Reading and Mathematics test scores, and the previous year Science test scores in the 2006-2007 school year than their mobile counterparts. These results remained even when controlling for economic status. Cohen's *d* indicated a small effect size for reading (i.e., 0.39) and a moderate effect size for mathematics (i.e., 0.58) and science (i.e., 0.54; Cohen, 1988). The average TAKS Reading test raw score for mobile students was 2.8 points lower than the average TAKS Reading test raw score for non-mobile students. Concerning the TAKS Mathematics exam, the average raw score for mobile students was 5.35 points lower than the average raw score for non-mobile students. Regarding the TAKS Science exam, the average raw score for mobile students was 4.83 points lower than the average raw score for non-mobile students. Delineated in Table 5 are the descriptive statistics for Grade 8 TAKS Reading, Mathematics, and Science scores by mobility and economic status for the 2006-2007 school year.

Table 5: Descriptive Statistics for Grade 8TAKS Reading, Mathematics, and Science Tests for Mobile and Non-Mobile Students for the 2006-2007 School Year

TAKS Test by Mobility Status	n	M	SD
Reading			
Non-Mobile	232,872	41.09	6.30
Mobile	4,463	38.29	7.84
Mathematics			
Non-Mobile	232,872	35.62	9.06
Mobile	4,463	30.27	9.31
Science			
Non-Mobile	232,872	33.92	8.86
Mobile	4,463	29.09	9.07

With respect to the 2007-2008 school year, as noted previously, student economic status was used as a covariate in research question a for each subject area. For these research questions, a MANCOVA statistical procedure was calculated. A statistically significant difference was yielded on student overall achievement, Wilks' $\Lambda = 1.0$, $p < .001$, partial $\eta^2 = .005$, trivial effect size, as a function of student mobility, and as a function of student poverty, Wilks' $\Lambda = .86$, $p < .001$, partial $\eta^2 = .14$, large effect size (Cohen, 1988). Congruent with the previous five years, poverty had a large influence on student achievement. A statistically significant difference was present between the covariate of economic status and TAKS Reading scores, $F(1, 237406) = 26527.78$, $p < .001$, $r = .34$; TAKS Mathematics scores, $F(1, 237406) = 43519.34$, $p < .001$, $r = .34$; and TAKS Science scores, $F(1, 237406) = 43519.34$, $p < .001$, $r = .30$. After controlling for the effect of economic status, a statistically significant effect of mobility remained for the TAKS reading scores, $F(1, 237406) = 658.31$, $p < .001$, partial $\eta^2 = .003$; TAKS Mathematics scores, $F(1, 237406) = 1033.14$, $p < .001$, partial $\eta^2 = .004$; and for the TAKS Science scores, $F(1, 237406) = 954.64$, $p < .001$, partial $\eta^2 = .004$.

For research question b for each subject area, the MANOVA revealed a statistically significant difference between mobile and non-mobile Grade 8 students in their overall achievement, Wilks' $\Lambda = 1.0$, $p < .001$, partial $\eta^2 = .005$, trivial effect size (Cohen, 1988). Follow-up ANOVA procedures also yielded statistically significant differences between mobile and non-mobile Grade 8 students in their TAKS Reading performance, $F(1, 237406) = 737.036$, $p < .001$, partial $\eta^2 = .003$; in their TAKS Mathematics performance, $F(1, 237406) = 1128.06$, $p < .001$, partial $\eta^2 = .005$; and in their TAKS Science performance, $F(1, 237406) = 1053.31$, $p < .001$, partial $\eta^2 = .004$.

Similar to the previous five years, non-mobile students had higher average TAKS Reading, Mathematics, and Science test scores in the 2007-2008 school year than their mobile counterparts. These results remained even when controlling for economic status. Cohen's *d* indicated a small effect size for reading (i.e., 0.39) and a moderate effect size for mathematics (i.e., 0.53) and science (i.e., 0.51; Cohen, 1988). The average TAKS Reading test raw score for mobile students was 2.43 points lower than the average TAKS Reading test raw score for non-mobile students. Concerning the TAKS Mathematics exam, the average raw score for mobile students was 4.85 points lower than the average raw score for non-mobile students. Regarding the TAKS Science exam, the average raw score for mobile students was 4.65 points lower than the average raw score for non-mobile students. Table 6 contains the descriptive statistics for Grade 8 TAKS Reading, Mathematics, and Science scores by mobility and economic status for the 2007-2008 school year.

Table 6: Descriptive Statistics for Grade 8TAKS Reading, Mathematics, and Science Tests for Mobile and Non-Mobile Students for the 2007-2008 School Year

TAKS Test by Mobility Status	n	M	SD
Reading			
Non-Mobile	233,633	42.56	5.43
Mobile	3,773	40.13	6.95
Mathematics			
Non-Mobile	233,633	37.17	8.79
Mobile	3,773	32.32	9.60
Science			
Non-Mobile	233,633	36.46	8.72
Mobile	3,773	31.81	9.38

XI. Discussion

The relationship between mobility and academic achievement in reading, mathematics, and science was considered for Grade 8 students both with and without controlling for student economic status. Data from the 2002-2003 to 2007-2008 were analyzed for reading and mathematics achievement and data from the 2005-2006 to 2007-2008 school years were analyzed for science achievement. All data were obtained from the Texas Education Agency Public Education Information Management System for all Texas Grade 8 students who were in an accountability subset for a campus or district. Statistically significant results were present for each school year and subject considered both when controlling for economic status and not controlling for economic status. Trends for each subject area were determined following the statistical analysis.

Non-mobile students had higher average performance on TAKS Reading than mobile students in all school years analyzed herein. Average reading scores differed between the two groups by as much as 15.84 points and as little as 2.43 points. Cohen's *d* was calculated for each year to evaluate the relative difference between the two groups across school years. These values are delineated in Table 7 and range from a high of 0.93 to a low of 0.31. As such these effect sizes were in the small to large range. Effect sizes below 0.50 were small, effect sizes between 0.51 and 0.79 were moderate, and the effect size values at 0.80 or above were large (Cohen, 1988).

Table7: Cohen's ds for Grade8 TAKS Reading Differences Between Mobile and Non-Mobile Students for the 2002-2003 Through the 2007-2008 School Years

School Year	d	Effect Size Range	Lowest Performing Group
2002-2003	0.31	Small	Mobile
2003-2004	0.38	Small	Mobile
2004-2005	0.40	Small	Mobile
2005-2006	0.44	Small	Mobile
2006-2007	0.39	Small	Mobile
2007-2008	0.39	Small	Mobile

Differences in the mobile and non-mobile groups' average scores were larger for the TAKS Mathematics test. Non-mobile students had a higher average performance on the TAKS Mathematics test than mobile students in each school year. Average mathematics scores differed between the two groups by as much as 14.47 points and as little as 4.85 points. Cohen's *d* was calculated for each year to evaluate the relative difference between the two groups across school years. These values are delineated in Table 8 and range from a high of 0.97 to a low of 0.35. As such these effect sizes were in the small to large range. Effect sizes below 0.50 were small, effect sizes between 0.50 and 0.79 were moderate, and the effect size values at 0.80 or above were large (Cohen, 1988).

Table 8: Cohen's ds for Grade 8 TAKS Mathematics Differences Between Mobile and Non-Mobile Students for the 2002-2003 Through the 2007-2008 School Years

School Year	d	Effect Size Range	Lowest Performing Group
2003-2004	0.49	Small	Mobile
2004-2005	0.48	Small	Mobile
2005-2006	0.68	Moderate	Mobile
2006-2007	0.58	Moderate	Mobile
2007-2008	0.53	Moderate	

Differences in the mobile and non-mobile groups' average scores were larger for the TAKS Science test than the TAKS Mathematics test but larger than the TAKS Reading test. Non-mobile students had higher average performance on the TAKS Science test than mobile students in each school year. Average science scores differed between the two groups by as much as 11.81 points and as little as 4.65 points. Cohen's *d* was calculated for each year to evaluate the relative difference between the two groups across school years. These values are delineated in Table 9 and range from a high of 0.92 to a low of 0.54. As such these effect sizes were in the moderate to large range. Effect sizes below 0.80 were moderate whereas the effect size values at 0.80 or above were large (Cohen, 1988).

Table 9: Cohen's ds for Grade 8 TAKS Science Differences Between Mobile and Non-Mobile Students for the 2002-2003 Through the 2007-2008 School Years

School Year	d	Effect Size Range	Lowest Performing Group
2005-2006	0.54	Moderate	Mobile
2006-2007	0.54	Moderate	Mobile
2007 2008	0.51	Moderate	Mobile

a) Implications for Policy and Practice

Campus and district accountability in Texas is determined based on the accountability subset. To be included in this group of students a student must be enrolled at a campus on the last Friday in October (i.e., Snapshot Day) and take the state standardized test (i.e., formerly the TAKS and now the State of Texas Assessment of Academic Readiness) on the same campus (Texas Education Agency, 2012). These parameters prevent the most mobile students from negatively influencing the campus accountability; however the most mobile students are also missing from this data set. Therefore a campus and district accountability set may include some mobile students but not the most mobile students.

The parameters of the accountability subset and the definition of a mobile student according to the Texas Education Agency (2012) definition create two subsets of mobile students. The first subset are those students who are mobile and included in an accountability subset, and the second is students who are mobile and not included in the accountability subset. In this separation of mobile students protects schools from the negative effects of mobility while excluding the most mobile students from the schools accountability. The presence of a statistically significant difference between mobile and non-mobile students but with small effect sizes when considering a data set that includes very few students not in an accountability subset indicates that Texas measures to protect schools from the negative effects of mobility have been successful. Numbers of students included in this study and included in an accountability subset or not is delineated in Table 10. However, the unintended consequences of accountability systems (Scherrer, 2013) may be that the most mobile students are excluded from needed interventions.

Table10: Sample Group Sizes for Grade 8 IncludedStudents

Year	Total Cases In Data Set	Included			
		Mobile		Not-Mobile	
		Accountability Subset	Non Accountability Subset	Accountability Subset	Non Accountability Subset
2003	304,906	4,507	135	213,409	16
2004	315,542	4,899	86	222,880	10
2005	320,637	4,968	132	226,876	6

2006	327,993	4,998	136	229,178	13
2007	331,203	4,379	91	232,931	7
2008	336,287	3,732	41	233,630	3

b) Connections with Existing Literature

The existing literature supports the results of this study indicating mobile students exhibit lower academic achievement than non-mobile students when controlling for and not controlling for economic status (e.g., Boroque, 2009; Bruno & Isken, 1996; Kerbow, 1995; Lovell & Isaacs, 2008; Reynolds, Chen, & Herbers, 2009; Scherrer, 2013). Conclusions in this study that the most mobile students are often excluded from data sets are congruent with previously produced research. Previous conclusions that the most mobile students are excluded from accountability subsets and therefore may be excluded from needed interventions have also been supported by this study.

The definition of mobility and the parameters of accountability subsets in Texas have created different classes of student mobility. Previous researchers (e.g., Scherrer, 2013) have also concluded that not all mobile students exhibit the same effects of mobility. Students who experience more mobility experience greater negative effects. Scarce resources require school officials to provide the most interventions for students who they will be held accountable for (Scherrer, 2013).

c) Recommendations for Future Research

Represented in Table 11 are students who were enrolled in Texas schools during the years of data analyzed in this study who were not included in the study due to missing scores. Mobile students were most frequently excluded from the study and were most frequently not included in accountability subsets. Research on students not included in accountability subsets would provide needed insight into the relationship between mobility and academic achievement.

Research considering prior academic achievement of mobile students would also be a valuable addition to the knowledge base. Improvements in tracking students across moves and years could have led to improvements in the data set. A more recent data set may be able to provide this added control variable. Other control variables such as gender and ethnicity could also be quality additions to the research base. Finally, research investigations into other middle grade levels (i.e., Grade 6 and Grade 7) would contribute to an understanding of the prevalence of negative effects of mobility.

XII. Summary

The effect of mobility on students' academic achievement and the relationship between mobility and economic disadvantage has been frequently debated. Texas has implemented measures to reduce the negative effects of mobile students on schools accountability. However, these measures have also removed many students most in need of assistance from schools accountability. In this multiyear, empirical investigation, most Grade 8 students excluded from the accountability subsets were not part of the statistical analyses. Of the subset of Grade 8 mobile students who were part of this study, they had lower academic achievement in reading, mathematics, and science than did their non-mobile peers. In all analyses, economic status had the strongest influence on Grade 8 student academic achievement. After controlling for the effects of poverty, however, mobility itself continued to have a statistically significant effect on Grade 8 student academic achievement.

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Table 11: Sample Group Sizes for Grade 8 Not Included Students

Year	Total Cases in Data Set	Not Included Mobile		Not-Mobile	
		Accountability Subset	Non Accountability Subset	Accountability Subset	Non Accountability Subset
2003	304,906	3,441	14,232	68,673	493
2004	315,542	3,472	14,072	69,699	424
2005	320,637	3,585	14,457	70,192	421
2006	327,993	3,831	15,942	73,466	429
2007	331,203	3,486	15,298	74,620	391
2008	336,287	4,456	22,276	71,475	674