Current Issues in Education
Mary Lou Fulton Teachers College • Arizona State University
PO Box 37100, Phoenix, AZ 85069, USA

Volume 16, Number 2 August 15, 2013 ISSN 1099-839X

Math and Reading Differences Between 6-8 and K-8 Grade Span Configurations: A Multiyear, Statewide Analysis

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We analyzed the effect of grade span configurations (i.e., 6-8 versus K-8) on reading and math performance in Texas public schools for the last 5 school years. Participants in this study were 628 Texas schools (i.e., 314 middle schools and 314 K-8 schools) distributed across the 5 school years examined. Schools configured as K-8 schools were matched to middle schools using a rigorous distance-based formula. All 15 reading comparisons (i.e., grade level by school year) yielded statistically significant results, with effect sizes ranging from small to large. Eleven of the 15 math comparisons yielded statistically significant results, with all of the effect sizes being small. Regardless of student grade level or school year examined, students who were enrolled in K-8 schools had higher average passing rates on the TAKS Reading and Math assessments than did students enrolled in middle schools. Implications of our findings are discussed.

Keywords: K-8, middle schools, grade span configuration, reading, math, Texas

The history of grade span configurations concerning adolescent students has been characterized as the "the longest-running debate in middle level educational research" (MacIver & Epstein, 1993, p. 520), and the "most extensive educational reform movement in the United States" (Lounsbury, 2009, p. 68). Spanning more than a century, the middle grades debate can best be described "as [the] ongoing search for the appropriate combination of school organization, curriculum, and instructional practices for young adolescents" (McEwin, Dickinson, & Jacobson, 2004, p. 1). However, researchers (Elovitz, 2007; Paglin & Fager, 1997) have noted that those individuals involved in this endeavor have raised more questions over the life of the debate than they have answered, and, as a result, an optimal configuration for adolescent education has yet to be identified.

Beginning in the 1980s, researchers (e.g., Blyth, Hill, & Smyth, 1981; Eccles & Midgley, 1989; Simmons & Blyth, 1987) began examining the effectiveness of middle schools in response to criticisms that the schools were not meeting the needs of adolescent students. Though various nonstandardized student variables (e.g., grades, social-emotional well-being, attendance, and perception) were initially studied, only results pertaining to the social-emotional well-being of students were significant in relation to the organizational structure of the school (Eccles, Lord, & Midgley, 1991; Simmons & Blyth, 1987; Weiss & Kipnes, 2006). More specifically, in well-controlled comparative studies (Anderman, 2002; Eccles et al., 1991; Moore, 1984; Reddy, Rhodes, & Mulhall, 2003; Simmons & Blyth, 1987; Weiss & Kipnes, 2006), students in middle schools had lower levels of self-

esteem and felt less secure in their environment as opposed to students in other grade span configurations (i.e., K-6 and K-8 school settings). However, these findings, which raised serious concerns in relation to the formation of adolescent students, led to very little in the way of school reform.

In the 1990s, the National Assessment of Educational Progress (NAEP) and the Trends in International Mathematics and Science Study (TIMSS) programs began testing eighth-grade students against national and international standards (NCES, 1999, 2011a). Results on the NAEP assessments during the 1990s revealed that roughly one third of students were proficient on standards set by the National Assessment Governing Board (NAGB) of the United States in reading, mathematics, and science (NCES, 2009, 2011b, 2011c). Additionally, TIMSS assessment results in the 1990s in mathematics and science placed student performance in the United States in the bottom half of the participating countries (with scale scores only slightly above the average) in relation to international standards set by multiple content experts, education professionals, and measurement specialists from countries around the world (NCES, 1999). Even after the advent of the No Child Left Behind Act (U.S. Department of Education, 2001), results on the NAEP and TIMSS assessments over the last 10 years have remained static (NCES, 2007, 2009, 2011b, 2011c).

Public criticism of the grade span configuration of middle schools began shortly after initial NAEP and TIMSS results were reported and sharply escalated after the passage of the NCLB Act (U.S. Department of Education, 2001). Middle schools were described as "the wasteland of our primary and secondary landscape" (Tucker & Codding, 1998, p. 153), and "the great disaster of the education system" (Jonas, 2007, p. E1). Yecke (2006), the former Chancellor of K-12 Public Schools for the Florida Department of Education, declared that "U.S. middle schools [were] where student academic achievement goes to die" (p. 20).

Despite poor national and international assessment results among adolescent students, and in the midst of harsh criticisms of middle schools, research related to the effects of grade span configurations on academic achievement has always been very limited (Coladarci & Hancock, 2002). Of the more than 3,700 studies pertaining to middle schools published between 1991 and 2003 (Hough, 2003), many researchers "decried the paucity of research related to the impact of grade level configuration on student academic success" (Schafer, 2010, p. 20). Of the research that did exist, most studies were plagued with errors related to design and reporting (Klump, 2006), and those studies that were statistically sound established either no significant relationship between academic achievement and grade span configurations or had effect sizes that were extremely small (Byrnes & Ruby, 2007). In regard to the state of Texas, only one study (Combs et al., 2011) was uncovered pertaining to grade span configurations and academic achievement. However, though a large and significant relationship was present between school configurations and student performance in that study favoring fifth-grade students enrolled in Grades K-5 schools, Combs et al. (2011) did not address the topic within the context of adolescent students and typical middle school configurations (and Grades K-5 and 5/5-6 school configurations were examined).

In the early 2000s, a massive school reform movement was launched in several states and several large school districts where school boards and administrators converted several hundred middle schools to a K-8 configuration (Hough, 2005). Byrnes and Ruby (2007) noted that although the K-8 reform movement was "gaining steam" across the country, the "subject matter [at that] point lacked the large and rigorous statistical research needed to provide scientific evidence for supporting such [policies]" (p. 102). In addition, Byrnes and Ruby (2007) commented that even though researchers examining "social engagement and attitudinal outcomes" (p. 104) had established a strong connection between results and grade span configurations, subsequent assertions made by the K-8 reform movement regarding academic achievement and school configurations had merely been implied from the previous research, under the assumption that negative results pertaining to the social-emotional well-being of students naturally affected academic performance.

Questions surrounding the optimal setting for adolescents with regard to academic achievement have never been adequately answered (Elovitz, 2007). Given the gap between recent reform policies and educational research, realistic expectations regarding school conversion policies (e.g., costs, resources required, and expected outcomes) cannot be detailed without more research. In addition, Howley (2002) has stressed the need for more state level research on grade span configurations and academic achievement, noting that most policy decisions regarding school organization are made at the state and local level. As such, this study was conducted in one state to examine the academic achievement of Grade 6, 7, and 8 students attending two different configurations (i.e., Grades 6-8 and K-8).

Conceptual Framework

During the course of the grade span debate, two conceptual frameworks have consistently been utilized. More specifically, school transition and instructional environment have been used by policy-makers, researchers, and reformers to frame aspects of adolescent education pertaining to grade span configurations. For the purpose of this research, transitions were used as a framework for researchers to compare grade configurations (e.g., 6-8 or K-8) with different numbers of

transitions for students. Students in the 6-8 middle school may have changed schools two or more times, whereas the Grade 6 students in the K-8 setting have not changed schools. Moreover, the same is true for the conceptual framework instructional environment framework because researchers (e.g., Jackson & Davis, 2000; McEwin, Dickinson, & Swaim, 1996; National Forum to Accelerate Middle Grades Reform, 2002) have suggested different configurations may influence the instructional environment.

According to Burkam, Michaels, and Lee (2007), grade span configurations are "inextricably linked" to school transitions "because grade spans dictate to a large degree when children will move between schools" (p. 290). Anderman and Midgley (1997) observed that students faced transitional effects when moving from grade to grade and teacher to teacher, but experienced the most effects when moving from school to school. These transitional effects include adjusting to new buildings, faculties, schedules, instructional configurations, and the student's new position in the social pecking order (Combs et al., 2011; Simmons & Blyth, 1987).

In the context of the grade span configuration debate, school transitions were initially seen as a benefit to adolescent students by providing them a middle tier of schooling that would prepare them for the rigors of high school (Bedard & Do, 2005). However, in the last 20 years, numerous researchers studying various social-emotional aspects of middle schools have come to associate the negative outcomes they have observed with the effects of school transition (Anderman & Midgley, 1997; Arcia, 2007; Bergquist, Bigbie, Groves, & Richardson, 2004; Cook, MacCoun, Muschkin, & Vigdor, 2008; Cromwell, 1999; Kennedy, 1993; Malaspina & Rimm-Kaufman, 2008; Mendez & Knoff, 2003; Simmons, Black, & Zhou, 1991; Weiss & Kipnes, 2006). In addition, researchers noticing declines in student confidence, leadership capabilities, and overall maturity levels would link these findings back to the phenomenon of social stratification, a by-product of school transition (Coladarci & Hancock, 2002; Herman, 2004; Simmons & Blyth, 1987; Yakimowski & Connolly, 2001). Although the effects of grade span configurations on academic achievement have yet to be determined with any level of confidence in literature, conducting this study under the conceptual framework of school transitions is appropriate given the prominence the theory has played in the examination of other student variables throughout the history of the debate.

The instructional environment of a school encompasses a large number of school characteristics and processes such as departmentalization, climate, curriculum, class size, grading practices, homework policies, and teaching styles (Wihry, Coladarci, & Meadow, 1992). In the context of grade span configurations, researchers have speculated that certain organizational structures can affect schools by making them more conducive to instructional environments that foster and support best practices in education (Juvonen, Le, Kaganoff, Augustine, & Constant, 2004). In the early stages of the grade span configuration debate, the organizational structures of junior high and middle schools were identified as being optimal for producing the best instructional environment for adolescents (Epstein & MacIver, 1990; Hough, 2005; Lee & Smith, 1993; Midgley, 1993). However, in the last 20 years, researchers have suggested that just the opposite might be true. More specifically, researchers analyzing various staffing practices in middle schools have observed that they suffer from lower rates of teacher retention, lower rates of teacher certification, and have less experienced teachers overall, when compared to elementary and high schools (Jackson & Davis, 2000; McEwin, Dickinson, & Swaim, 1996; National Forum to Accelerate Middle Grades Reform, 2002). In addition, Erb (2006) noted that the problems associated with staffing at the middle school level had a negative impact on a school's ability to foster a positive instructional environment. Finally, a number of researchers (Byrnes & Ruby, 2007; Coladarci & Hancock, 2002; Hough, 2005; Offenberg, 2001; Yakimowski & Connolly, 2001) compared instructional practices between middle and K-8 schools and observed that strategies such as team teaching, professional learning communities, and mixed level classrooms were more commonly present in the K-8 school setting than in the middle school setting.

Purpose of the Study and Research Questions

The purpose of this study was to determine the effect of grade span configurations on academic achievement in middle (Grades 6 through 8) and K-8 (Grades EE/PK/KG-8) Texas public schools. More specifically, academic achievement was examined and compared between two different school settings (i.e., middle schools and K-8 schools) for sixth-, seventh-, and eighth-grade students. Academic achievement was measured by assessing the passing rates of students in Grades 6, 7, and 8 on the Texas Assessment of Knowledge and Skills (TAKS) Reading and Mathematics assessments for the 2006-2007, 2007-2008, 2008-2009, 2009-2010, and 2010-2011 school years. These years were selected because they were the most current data available at the time of this study and we wanted to determine if the results were consistent from year to year. The following research questions were addressed: (a) What is the difference in reading achievement between middle and K-8 school settings as a function of grade level (i.e., Grade 6, 7, and 8)? and (b) What is the difference in math achievement between middle and K-8 school settings as a function of grade level (i.e., Grade 6, 7, and 8)? Both of these research questions were repeated for each of the 5 years of data analyzed.

Method

Selection of Participants

Participants in this study consisted of 628 Texas schools comprising 314 middle schools (Grades 6-8) and 314 K-8 schools (Grades EE/PK/KG-8), drawn from 5 school years, 2006–2011. Middle schools were selected for this study because they currently serve more sixth-, seventh-, and eighth-grade students combined than any other grade span configuration in Texas. Grades K-8 schools were selected because they represent the most prevalent grade span configuration in the national school organization debate. Total populations of Texas sixth, seventh, and eighth-grade students combined are detailed by grade span configuration and year in Table 1 (TEA, 2007, 2008a, 2009, 2010, 2011a).

To conduct dependent statistical analyses on student achievement data for the campuses (Field, 2005; Gall et al., 2005; Howell, 2007; Sprinthall, 2003), K-8 schools were matched to middle schools using a rigorous distance-based (difference) formula developed by Clark (2009). This distance-based formula accounted for the following campus variables: (a) school size, (b) percent of Black students, (c) percent of Hispanic students, (d) percent of White students, (e) percent of students with low socioeconomic status, and (f) campus mobility rates. Therefore, campus compositions were very similar for the two groups (Grades 6-8 and Grades K-8).

Instrumentation

The TAKS Reading and Mathematics examinations, which are comprehensive statewide assessments, were used to measure the dependent variables in this study (TEA, 2011c). Campus passing rates in mathematics and in reading have a possible range of 0 to 100 and represent the percentage of students who met the minimum passing requirements for each examination (TEA, 2011c). For accountability purposes, participation thresholds must be met before any TAKS examination is used in the overall evaluation of a campus (TEA, 2008b). However, evaluation purposes aside, the AEIS includes TAKS results for any grade level subject where at least five students on a campus have taken a test (TEA, 2011b). These non-evaluated results comprised a critical component of this study, because a large number of K-8 schools in Texas had entire grade cohorts that contained fewer than 30 students (TEA, 2007, 2008a, 2009, 2010, 2011a).

Procedures

For this study, middle schools were classified as those schools containing Grades 6 through 8, and K-8 schools were classified as though schools containing grade levels Kindergarten and/or Pre-Kindergarten and/or Early Education through Grade 8. Campuses that did not fall into these classifications were excluded from the study. Datasets for each school in one of the four classifications coded by the TEA (i.e., grade span 6-8, EE-8, PK-8, KG-8) were formed from the AEIS database for each of 5 school years, 2006-2011. All middle and K-8 school campuses were reclassified into one of two categories (i.e., 6-8, K-8) and consolidated into a single dataset. In addition, campuses classified as charter schools and alternative education campuses by the AEIS were excluded from the study, as were campuses that did not meet the minimum AEIS reporting threshold of five students in any of the TAKS tests examined. The number of K-8 and middle schools available in the matching pool are shown in Table 2.

Table 1
Total Student Population of Grade 6, 7, and 8 by Grade Span Configuration in Texas by Year in 1,000s

Grade Span	2006-2007	2007-2008	2008-2009	2009-2010	2010-2011
6-8	640.8	653.1	668.3	690.4	707.6
7-8	179.2	164.5	171.8	170.8	168.7
5-6	42.7	41.5	45.7	47.4	48.4
KG-6	39.6	34.5	32.4	32.2	32.8
5-8	18.2	21.1	21.9	16.9	16.5
6-6	13.7	14.6	14.3	14.8	13.9
KG-8	10.4	9.6	10.6	11.3	12.7
KG-12	9.4	9.2	9.7	10.3	11.6
7-9	9.4	14.1	9.5	8.5	11.2

Table 2
Number of K-8 Schools and Middle Schools in the Matching Pool by Year

School Year	# of K-8 Schools	# of Middle Schools in the Matching Pool
2006-2007	66	886
2007-2008	65	926
2008-2009	60	938
2009-2010	62	971
2010-2011	61	988

In an attempt to isolate the effect of grade span organizational patterns on student achievement and to enable the use of dependent statistical tests later in the study (Field, 2005; Gall et al., 2005; Howell, 2007; Sprinthall, 2003), Clark's (2009) distance (i.e., smallest difference) based formula was used to match all middle and K-8 schools using a procedure with the following five steps: (a) select the matching variables, (b) identify and account for any missing data, (c) standardize the matching variables; (d) find optimal matches for each target school, and (e) validate the matching procedure. Each of these steps was used in this study as a matching technique pairing a target school (i.e., K-8 school) to another school (i.e., middle school) in a comparison pool by calculating the distance (i.e., smallest difference) between the target school and all schools in the pool with respect to one or more matching variables, and then selecting the school that yielded the smallest difference to serve as a match. As such, this technique was repeated until all target schools were matched (Clark, 2009).

Data Analysis

Analysis of standardized skewness coefficients and standardized kurtosis coefficients for the TAKS campus passing rates on the Grade 6, Grade 7, and Grade 8 reading assessment for the 2006-2007, 2007-2008, 2008-2009, 2009-2010, and 2010-2011 school years revealed numerous deviations from normally distributed data, with coefficients for standardized skewness ranging from -6.14 to 8.64 and coefficients for standardized kurtosis ranging from -6.34 to 9.93 at their most extremes (Onwuegbuzie & Daniel, 2002). Given the predominance of deviations from normally distributed data, nonparametric statistical procedures were selected for answering each of the research questions related to reading achievement posed in this study. More specifically, Wilcoxon matched-pairs signed-ranked tests were conducted between the matched pairs of middle and K-8 schools for the TAKS Reading assessments for each of the 5 school years selected for use in this study.

Analysis of standardized skewness coefficients and standardized kurtosis coefficients for the TAKS campus passing rates on the Grade 6, 7, and 8 mathematics assessment for the 2006-2007, 2007-2008, 2008-2009, 2009-2010, and 2010-2011 school years revealed numerous deviations from normally distributed data, ranging from -6.29 to 9.49 at their most extremes (Onwuegbuzie & Daniel, 2002). Given the predominance of deviations from normally distributed data, nonparametric statistical procedures were selected for answering each of the research questions related to mathematics achievement posed in this study. More specifically, Wilcoxon matched-pairs signed-ranked tests were conducted between the matched pairs of middle and K-8 schools for the TAKS Mathematics assessments examined for each of the 5 school years selected for use in this study.

Results

Reading Passing Rates

To determine the effect of grade span configurations on academic achievement in Grade 6 reading over a 5-year period, five individual Wilcoxon's tests were conducted. In all five school years examined, Grade 6 students attending a K-8 school had statistically significantly higher scores in reading than did Grade 6 students attending a middle school with large to moderate effect sizes (2006-2007, $z[66] = -2.76$, $p = .006$, $d = 0.42$; 2007-2008, $z[65] = -4.43$, $p < .001$, $d = 0.85$; 2008-2009, $z[60] = -3.42$, $p = .001$, $d = 0.51$; 2009-2010, $z[62] = -2.23$, $p = .026$, $d = 0.40$; 2010-2011, $z[61] = -3.03$, $p = .002$, $d = 0.59$; see Table 3 for detailed results). Grade 6 students attending a K-8 school had higher average reading scores than Grade 6 students attending a middle

Table 3
Descriptive Data for Grade 6, 7, and 8 TAKS Reading Passing Rates by Grade Span Configuration and School Year

Grade Level and School Year	6-8 School Setting			K-8 School Setting		
	M	*SD*	*N*	*M*	*SD*	*n*
Grade 6						
2006-2007	90.48	7.18	66	93.55	7.29	66
2007-2008	91.40	5.45	65	95.95	5.29	65
2008-2009	91.83	4.59	60	94.58	6.26	60
2009-2010	83.32	8.39	62	86.71	8.39	62
2010-2011	82.05	9.00	61	87.16	8.19	61
Grade 7						
2006-2007	83.53	9.99	66	90.27	9.05	66
2007-2008	86.15	7.02	65	90.48	8.62	65
2008-2009	85.70	6.51	60	91.65	9.64	60
2009-2010	85.10	8.63	62	88.15	10.28	62
2010-2011	85.66	8.44	61	91.18	7.46	61
Grade 8						
2006-2007	88.47	6.40	66	92.24	8.02	66
2007-2008	94.05	4.59	65	97.15	4.21	65
2008-2009	94.82	3.44	60	96.42	4.84	60
2009-2010	90.52	5.73	62	93.31	7.46	62
2010-2011	88.75	6.78	61	92.64	7.98	61

Table 4
Results for Grade 6, 7, and 8 TAKS Reading Passing Rates by Year

Grade Level and School Year	Outcome	Effect Size	Highest Passing Rate
Grade 6			
2006-2007	Significant	0.42 (Small)	K-8 Schools
2007-2008	Significant	0.85 (Large)	K-8 Schools
2008-2009	Significant	0.51 (Moderate)	K-8 Schools
2009-2010	Significant	0.40 (Small)	K-8 Schools
2010-2011	Significant	0.59 (Moderate)	K-8 Schools
Grade 7			
2006-2007	Significant	0.71 (Moderate)	K-8 Schools
2007-2008	Significant	0.55 (Moderate)	K-8 Schools
2008-2009	Significant	0.72 (Moderate)	K-8 Schools
2009-2010	Significant	0.32 (Small)	K-8 Schools
2010-2011	Significant	0.69 (Moderate)	K-8 Schools
Grade 8			
2006-2007	Significant	0.52 (Moderate)	K-8 Schools
2007-2008	Significant	0.70 (Moderate)	K-8 Schools
2008-2009	Significant	0.38 (Small)	K-8 Schools
2009-2010	Significant	0.42 (Small)	K-8 Schools
2010-2011	Significant	0.53 (Moderate)	K-8 Schools

school in all 5 years studied. Descriptive statistics for the Grade 6 TAKS campus passing rates in reading between the matched campuses are presented in Table 3.

Summarized in Table 4 are results from the five Wilcoxon's tests conducted for the Grade 6 TAKS Reading assessments for the 5 years studied. Summary statistics are detailed by year and present findings relative to statistical significance and effect size.

To ascertain the effect of grade span configurations on academic achievement in Grade 7 reading over a 5-year period, five individual Wilcoxon's tests were conducted. In all 5 years examined, Grade 7 students attending a K-8 school had statistically significantly higher scores in reading than did Grade 7 students attending a middle school with moderate effect sizes (2006-2007, $z[66] = -4.66$, $p < .001$, $d = 0.71$; 2007-2008, $z[65] = -3.56$, $p < .001$, $d = 0.55$; 2008-2009, $z[60] = -4.11$, $p < .001$, $d = 0.72$; 2009-2010. $z[62] = -2.35$, $p = .019$, $d = 0.32$; 2010-2011, $z[61] = -4.25$, $p < .001$, $d = 0.69$; see Table 3 for detailed results). Grade 7 students attending a K-8 school had higher average reading scores than Grade 7 students attending a middle school in all 5 years studied. Detailed in Table 4 are results from the five Wilcoxon's tests conducted for the Grade 7 TAKS Reading assessments for the 5 years studied. Summary statistics are detailed by year and present findings relative to statistical significance and effect size.

To determine the effect of grade span configurations on academic achievement in Grade 8 reading over a 5-year period, five individual Wilcoxon's tests were conducted. In all 5 years examined, Grade 8 students attending a K-8 school had statistically significantly higher scores in reading than did Grade 8 students attending a middle school with moderate effect sizes (2006-2007, $z[66] = -3.64$, $p < .001$, $d = 0.52$; 2007-2008, $z[65] = -4.08$, $p < .001$, $d = 0.70$; 2008-2009, $z[60] = -2.48$, $p = .013$, $d = 0.38$; 2009-2010, $z[62] = -2.71$, $p = .007$, $d = 0.42$; 2010-2011, $z[61] = -3.10$, $p = .002$, $d = 0.53$; see Table 3 for detailed results). Grade 8 students attending a K-8 school had higher average reading scores than Grade 8 students attending a middle school in all 5 years studied (see Table 3 for detailed descriptive results). Depicted in Table 4 are the results from the five Wilcoxon's tests conducted for the Grade 8 TAKS Reading assessments for the 5 years studied. Summary statistics are detailed by year and present findings relative to statistical significance and effect size.

In summary, for reading the effect of grade span configuration on TAKS passing rates revealed statistically significant differences in all 15 grade/year categories (i.e., 5 years for three grade levels) examined. Effect sizes ranged from small to large, with the majority of the effect sizes being moderate (Cohen, 1988). In all of the grade/year categories analyzed for reading, students in a K-8 school setting had higher average passing rates than did students in a middle school setting.

Table 5
Descriptive Data for Grade 6, 7, and 8 TAKS Mathematics Passing Rates by Grade Span Configuration and School Year

Grade Level and School Year	6-8 School Setting			K-8 School Setting		
	M	*SD*	*N*	*M*	*SD*	*n*
Grade 6						
2006-2007	74.82	15.65	66	80.88	15.25	66
2007-2008	79.12	12.57	65	85.29	12.80	65
2008-2009	80.68	9.99	60	81.43	14.50	60
2009-2010	78.71	12.14	62	82.95	12.63	62
2010-2011	80.90	9.78	61	84.38	12.05	61
Grade 7						
2006-2007	73.83	14.79	66	79.74	16.47	66
2007-2008	77.40	12.44	65	81.37	13.81	65
2008-2009	79.52	12.83	60	84.88	12.72	60
2009-2010	80.71	11.96	62	84.27	15.83	62
2010-2011	81.34	11.11	61	85.74	9.97	61
Grade 8						
2006-2007	69.82	13.62	66	77.08	15.76	66
2007-2008	78.17	10.86	65	82.14	15.67	65
2008-2009	80.78	12.60	60	83.98	13.55	60
2009-2010	81.63	10.77	62	84.47	13.73	62
2010-2011	79.69	11.22	61	85.21	13.99	61

Table 6
Results for Grade 6, 7, and 8 TAKS Mathematics Passing Rates by Year

Grade Level and School Year	Outcome	Effect Size	Highest Passing Rate
Grade 6			
2006-2007	Significant	0.39 (Small)	K-8 Schools
2007-2008	Significant	0.49 (Small)	K-8 Schools
2008-2009	Not Significant		K-8 Schools
2009-2010	Significant	0.34 (Small)	K-8 Schools
2010-2011	Significant	0.32 (Small)	K-8 Schools
Grade 7			
2006-2007	Significant	0.38 (Small)	K-8 Schools
2007-2008	Not Significant		K-8 Schools
2008-2009	Significant	0.42 (Small)	K-8 Schools
2009-2010	Significant	0.25 (Small)	K-8 Schools
2010-2011	Significant	0.42 (Small)	K-8 Schools
Grade 8			
2006-2007	Significant	0.49 (Small)	K-8 Schools
2007-2008	Not Significant		K-8 Schools
2008-2009	Not Significant		K-8 Schools
2009-2010	Significant	0.23 (Small)	K-8 Schools
2010-2011	Significant	0.44 (Small)	K-8 Schools

Mathematics Passing Rates

To ascertain the effect of grade span configurations on academic achievement in Grade 6 mathematics over a 5-year period, five individual Wilcoxon's tests were conducted. In 4 of the 5 years examined, Grade 6 students attending a K-8 school had statistically significantly higher scores in mathematics than did Grade 6 students attending a middle school with a small effect size (2006-2007, $z[66] = -2.48$, $p = .013$, $d = 0.39$; 2007-2008, $z[65] = -3.18$, $p = .001$, $d = 0.49$; 2008-2009, $z[60] = -0.78$, $p = .435$; 2009-2010, $z[62] = -2.28$, $p = .023$, $d = 0.34$; 2010-2011, $z[61] = -2.15$, $p = .032$, $d = 0.32$; see Table 5 for detailed results). Grade 6 students attending a K-8 school had higher average mathematics scores than Grade 6 students attending a middle school in all 5 years studied (see Table 5 for detailed descriptive results). Summarized in Table 6 are results from the five Wilcoxon's tests conducted for the Grade 6 TAKS Mathematics assessments for the 5 years of data analyzed. Summary statistics are detailed by year and present findings relative to statistical significance and effect size.

To determine the effect of grade span configurations on academic achievement in Grade 7 mathematics over a 5-year period, five individual Wilcoxon's tests were conducted. In four of the five school years, statistically significant findings were revealed (2006-2007, $z[66] = -2.14$, $p = .032$, $d = 0.38$; 2007-2008, $z[65] = -1.32$, $p = .187$; 2008-2009, $z[60] = -2.61$, $p = .009$, $d = 0.42$; 2009-2010, $z[62] = -2.11$, $p = .035$, $d = 0.25$; 2010-2011, $z[61] = -2.62$, $p = .009$, $d = 0.42$; see Table 5 for detailed results). Grade 7 students attending a K-8 school had higher average mathematics scores than did Grade 7 students attending a middle school in all 5 years studied (see Table 5 for detailed descriptive results). Detailed in Table 6 are results from the five Wilcoxon's tests conducted for the Grade 7 TAKS Mathematics assessments for the 5 years studied. Summary statistics are detailed by year and present findings relative to statistical significance and effect size.

To ascertain the effect of grade span configurations on academic achievement in Grade 8 mathematics over a 5-year period, five individual Wilcoxon's tests were conducted. In three of the five school years examined, Grade 8 students attending a K-8 school had statistically significantly higher scores in mathematics than did Grade 8 students attending a middle school, with small effect sizes (2006-2007, $z[66] = -2.95$, $p = .003$, $d = 0.49$; 2007-2008, $z[65] = -1.73$, $p = .084$; 2008-2009, $z[60] = -1.39$, $p = .163$; 2009-2010, $z[62] = -1.96$, $p = .05$, $d = 0.23$; 2010-2011, $z[61] = -2.90$, $p = .004$, $d = 0.44$). Grade 8 students attending a K-8 school had higher average mathematics scores than Grade 8 students attending a middle school in all 5 years studied (see Table 5 for detailed descriptive results). Summarized in Table 6 are the results from the five Wilcoxon's tests conducted for the Grade 8 TAKS Mathematics assessments for the 5 years studied. Summary statistics are detailed by year and present findings relative to statistical significance and effect size.

Discussion

Results herein support previous researchers who

have demonstrated statistically significant relationships between grade span configurations and academic achievement, with results favoring K-6, K-7, and K-8 school settings over the middle school setting (e.g., Becker, 1987; Byrnes & Ruby, 2007; Collins, 2006; Connolly, Yakimowski-Srebnick, & Russo, 2002; Fink, 2010; Franklin & Glasscock, 1996; Offenburg, 2001; Schafer, 2010; Tucker & Andrada, 1997; Wihry et al., 1992). However, in comparing methodologies and reporting practices between this present study and past research, several differences are apparent. Existing studies pertaining to the effect of grade span configurations on academic achievement have been plagued with errors related to methodology and reporting (Klump, 2006). In several past studies (e.g., Collins, 2006; Connolly et al., 2002; Sanders-Smith, 2009; Tucker & Andrada, 1997), researchers did not attempt to control for student and campus level variables known to have a significant effect on academic achievement.

In addition to controlling for variables that influence achievement, the current literature base on grade span configurations is extended by this research study by the introduction of a new methodology for matching campuses with differing grade span configurations for examining the influence school configuration has on academic achievement. Though the matching process employed in this study was used once previously in Combs et al. (2011), that process was expanded and refined herein by adding additional statistical measures around determining which matching variables require standardization within their school classification.

Other key differences between the results of this study and past research pertain to the breadth of significant findings and effect sizes associated with those results. Whereas past researchers have documented statistically significant findings for the majority, if not all, of the research questions they have posed in relation to grade span configurations and academic achievement (e.g., Becker, 1987; Byrnes & Ruby, 2007; Collins, 2006; Connolly et al., 2002; Franklin & Glasscock, 1996; Offenberg, 2001; Schafer, 2010; Tucker & Andrada, 1997; Wihry et al., 1992), the results of this present study revealed statistically significant findings in almost all of the statistical analyses. Students in this study who were in a K-8 school setting had higher average TAKS Reading and Math passing rates in all grades and years examined than did students in a middle school setting. Concerning effect sizes, in cases where past researchers reported effect sizes for their findings (e.g., Byrnes & Ruby, 2007; Tucker & Andrada, 1997), the detailed effect sizes were extremely small (Cohen, 1988). In contrast, the statistically significant findings observed in this study yielded small to large effect sizes, with the majority falling into the moderate range (Cohen, 1988).

The closest match to the present study in the body of literature was research conducted by Combs et al. (2011). In both studies, campuses in Texas were paired on several campus variables using Clark's (2009) matching process prior to analyses of the effect of grade span configurations on academic achievement. In addition, TAKS passing rates were used in both studies as the instrument for measuring academic achievement, and similar effect sizes were present with respect to size and distribution in their results. Combs et al. (2011) detailed effect sizes in the small to moderate range, whereas in the present study effect sizes ranged from small to large (Cohen, 1988). However, one key difference distinguishes the two studies from each other. The key difference is that Combs et al. analyzed scores from Grade 5 students in K-5 and 5-6 grade span configurations in the subjects of mathematics and reading, whereas scores from Grade 6, 7, and 8 students in K-8 and 6-8 school settings in the subjects of mathematics and reading were examined in this investigation.

During the course of the grade span debate, two conceptual frameworks have consistently been utilized. More specifically, school transition and instructional environment have been used by policymakers, researchers, and reformers to frame aspects of adolescent education pertaining to grade span configurations. The matching process used in this study enabled the use of dependent inferential statistical tests and controlled for campus variables known to have a significant effect on academic achievement (Byrnes & Ruby, 2007; Juvonen et al., 2004). By using Clark's (2009) matching process, possible linkages of statistically significant findings to the conceptual frameworks of school transition and instructional environment were sought. Though no direct cause and effect relationships can be established using a causal-comparative research design (Gall et al., 2005), after controlling for school size, SES, ethnicity, and mobility in this present study, statistically significant results can be causally connected back to both conceptual frameworks. Given the "inextricable link" (Burkam et al., 2007, p. 290) between school transition and grade span configurations, as a result of this study it is apparent that the grade configuration offering fewer transitions (i.e., K-8) is linked with higher student achievement. However, in attempting to relate the results from this study back to the conceptual framework of instructional environments, it is important to note that no attempt was made in this study to determine the instructional practices of the participating campuses. As a result, a recommendation for future research is detailed in the following section to examine further the connection of results in this study to the framework of instructional environment.

Implications and Conclusions

Given that research is limited related to grade span configurations, policymakers (e.g., state education

officials, legislators, local school board members, superintendents, and district administrators) should view the findings of this study as a starting point for future discussions about an optimal school configuration for adolescent students. Even though students in the present study had higher average passing rates in mathematics and readings in all grades and years examined in a K-8 school setting than did students in a middle school setting, the severe lack of a comprehensive body of research pertaining to this topic should preclude state and local decision makers from assuming any justification for implementing a school conversion policy.

Having noted this concern, we echo the words of one of the reviewers of this article. Given that decisions about grade span configuration are being made, what is the basis upon which those decisions are made? If grade span configuration decisions are currently being made on the basis of no empirical research, we do not believe that to be a wise practice. Though we certainly believe that our findings need to be replicated, we also believe that they do provide some evidence for policymakers to use in making grade span configuration decisions.

Superintendents and school boards who may be considering grade-span configurations for restructuring and/or for future facilities needs are encouraged to read this study and other studies regarding elementary and middle schools grade configurations. As presented in this study, several researchers have analyzed the influence of grade span or grade configuration and student achievement. Granted, facility and organization decisions are often based more on financial reasons than achievement reasons; therefore, we suggest superintendents and school boards look at achievement concerns as well as economies of scale.

In regard to future research, a study is needed, which could serve as a follow-up to this present study, to examine the instructional environments between pairs of matched campuses to determine the extent to which certain strategies such as team teaching, professional learning communities, and mixed level classrooms are present as a function of a school's grade span configuration. Past researchers (e.g., Byrnes & Ruby, 2007; Coladarci & Hancock, 2002; Hough, 2005; Offenberg, 2001; Yakimowski & Connolly, 2001) have reported that such instructional practices were more commonly present in K-8 school settings than in middle schools, and further validation of this observation for schools in Texas would strengthen the conceptual framework concerning the role of instructional environment in student achievement.

Finally, to expand the nation-wide body of literature pertaining to grade span configurations, further studies should be replicated in other states. After more than 10 years of post-NCLB state assessments, the data for such studies are readily available. If such studies were conducted, a preponderance of evidence might point educators, researchers, and policy-makers to an optimal school configuration for adolescent students. Furthermore, research related to grade span and economies of scale may provide all stakeholders with additional information from which to make decisions about facilities and grade organization.

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Article Citation
Clark, D. M., Slate, J. R., Combs, J. P., & Moore, G. W. (2013). Math and reading differences between 6-8 and K-8 grade span configurations: A multiyear, statewide analysis. *Current Issues in Education*, *16*(2). Retrieved from http://cie.asu.edu/ojs/index.php/cieatasu/article/view/1144

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Current Issues in Education

Mary Lou Fulton Teachers College • Arizona State University
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Manuscript received: 12/10/2012
Revisions received: 04/12/2013
Accepted: 05/19/2013

Current Issues in Education
Mary Lou Fulton Teachers College • Arizona State University
PO Box 37100, Phoenix, AZ 85069, USA

Volume 16, Number 2 August 15, 2013 ISSN 1099-839X