School Effectiveness and School Improvement
An International Journal of Research, Policy and Practice

ISSN: 0924-3453 (Print) 1744-5124 (Online) Journal homepage: https://www.tandfonline.com/loi/nses20

Grade configuration is associated with school-level standardized test pass rates for sixth-, seventh-, and eighth-grade students

Marisa Malone, Dewey G. Cornell & Kathan Shukla

To cite this article: Marisa Malone, Dewey G. Cornell & Kathan Shukla (2020) Grade configuration is associated with school-level standardized test pass rates for sixth-, seventh-, and eighth-grade students, School Effectiveness and School Improvement, 31:2, 289-305, DOI: 10.1080/09243453.2019.1654526

To link to this article: https://doi.org/10.1080/09243453.2019.1654526

SCHOOL EFFECTIVENESS AND SCHOOL IMPROVEMENT
2020, VOL. 31, NO. 2, 289–305
https://doi.org/10.1080/09243453.2019.1654526

Routledge
Taylor & Francis Group

Grade configuration is associated with school-level standardized test pass rates for sixth-, seventh-, and eighth-grade students

Marisa Malone [a], Dewey G. Cornell[a] and Kathan Shukla[b]

[a]Curry School of Education, University of Virginia, Charlottesville, VA, USA; [b]Ravi J. Matthai Centre for Educational Innovation, Indian Institute of Management Ahmedabad, Vastrapur, Ahmedabad, India

ABSTRACT

Educators and researchers have long debated the best grade configuration grouping for middle grade students. This study examined school-level differences in reading and mathematics standardized test pass rates for students placed in middle schools versus alternative grade configurations. Latent growth modeling was conducted separately for 6th, 7th, and 8th grades across a 3-year sampling period. Sixth-grade pass rates were significantly higher in elementary schools (e.g., Kindergarten–7th grade) than in middle schools for reading (78.9% vs. 72.0%) and mathematics (82.5% vs. 76.3%). Seventh-grade pass rates in elementary schools were also significantly higher than in middle schools for reading (78.5% vs. 75.9%) and mathematics (83.1% vs. 69.2%). Eighth-grade pass rates were significantly higher in middle schools than in high schools (e.g., 8th–12th grade) for both subjects (74.7% vs. 70.0% for reading, 63.3% vs. 52.0% for mathematics). These findings suggest that students benefit from remaining in elementary school through at least 7th grade.

ARTICLE HISTORY
Received 15 January 2018
Accepted 6 August 2019

KEYWORDS
Middle school; grade configuration; academic achievement

Introduction

The middle school years are a challenging period for adolescents. Simultaneous with physical, social, and emotional changes (Larson, Moneta, Richards, & Wilson, 2002; Nelson, Leibenluft, McClure, & Pine, 2005), many young adolescents also navigate the transition to middle school. The middle school experience is associated with a decline in academic motivation and achievement (e.g., Goldstein, Boxer, & Rudolph, 2015; Rockoff & Lockwood, 2010) and has stimulated calls in the United States for middle school reform (Juvonen, Le, Kaganoff, Augustine, & Constant, 2004).

Over the past several decades, researchers in the United States have investigated whether the middle-grade decline in academic achievement is developmentally normative or is specific to adolescents attending middle schools by comparing student achievement in schools with differing grade configurations. School grade configuration is the span of grades served by an individual school. Variations in grade configuration have not been extensively examined outside of the United States, possibly because other countries have

CONTACT Marisa Malone mm2eb@virginia.edu
This article has been republished with minor changes. These changes do not impact the academic content of the article.

more uniform configurations for their general education programs (European Commission/EACEA/Eurydice, 2017). While most adolescents in the United States attend middle schools that are comprised of sixth, seventh, and eighth grades, other students attend schools with a different grade configuration, such as those with elementary or high school grades (e.g., Grades Kindergarten–8 or 7–12). School grade configuration is important because it affects the number of schools that children attend and how old they are at the time of each transition. Additionally, student experiences may differ between configurations. For example, students in elementary schools tend to have one teacher for most of their subjects, whereas students in middle school typically move from classroom to classroom for each subject, thus limiting the opportunity to develop strong relationships with their teachers.

What is the best grade configuration to facilitate achievement in middle grade students? Until the 1970s, most American public school students attended elementary school through Grade 6 before moving into junior high schools. Junior high schools typically consisted of Grades 7 through 8 or 7 through 9 and were intended to prepare students for the more demanding and rigorous high school curriculum. Early studies showed that students who attended junior highs experienced poorer outcomes than students who stayed in elementary school through eighth grade. A review by Eccles, Lord, and Midgley (1991) found that the transition to junior high school was associated with poorer academic achievement, decreased motivation, lower sense of school belongingness, and poor self-esteem. Eccles et al. (1991), along with other researchers, argued that middle grade students need a more developmentally appropriate and supportive school environment that recognizes and attends to the unique developmental characteristics of students in this age range.

School districts in the United States began to shift to sixth- through eighth-grade middle schools in the early 1970s. From 1970 to 2013, the number of middle schools (most containing Grades 6–8) in the United States increased by 528%, and the number of junior high schools decreased by 62% (National Center for Education Statistics, 2015). There was little scientific rationale for this rapid restructuring of schools, and studies now conclude that attending middle school is linked to poor academic and behavioral outcomes (Juvonen et al., 2004). For example, sixth-grade students in middle schools are more likely to exhibit lower academic competency (Anderman & Midgley, 1997), more disciplinary problems (Cook, MacCoun, Muschkin, & Vigdor, 2008), and poorer attendance (Schwerdt & West, 2013) than sixth graders in elementary schools. These negative associations appear to be evident throughout middle school; eighth graders in middle schools report lower self-esteem (Weiss & Kipnes, 2006), a weaker sense of belonging at school, and lower grade point averages (Anderman, 2002).

Sixth- and seventh-grade studies

Given that most students in the United States begin middle school in sixth or seventh grade, most of the grade configuration research has examined academic and behavioral outcomes for these students. Studies generally show that students entering middle school in sixth grade demonstrate poorer academic achievement in comparison to students in Kindergarten through eighth-grade (K–8) schools. One study of over 44,000 students in 243 North Carolina state schools found that students who entered

middle school in sixth grade had reduced academic performance for reading achievement in comparison to sixth-grade students who remained in elementary schools (Cook et al., 2008). Similarly, Poncelet and Metis Associates (2004) found that sixth graders in Kindergarten through eighth-grade schools in Cleveland city demonstrated greater mathematics and reading achievement than students in sixth- through eighth-grade schools. In contrast, Dove, Pearson, and Hooper (2010) found no relationship between grade configuration and mathematics or literacy scores for sixth-grade students in Arkansas middle schools.

Two large, longitudinal studies also support the use of an elementary school configuration for middle grade students. Tracking a sample of over 100,000 students in New York City over a 10-year period, Rockoff and Lockwood (2010) found large differences in academic achievement for sixth- and seventh-grade students attending middle school versus those who did not attend middle school. Students entering middle schools in either sixth or seventh grade demonstrated lower mathematics and reading achievement scores during the transition year (about .15 standard deviations) than students who did not change schools, with poorer scores persisting through at least eighth grade. Furthermore, students entering middle school in sixth grade had a greater loss of achievement than those entering in seventh grade (Rockoff & Lockwood, 2010).

A second study obtained similar findings using a longitudinal statewide sample in the state of Florida. Schwerdt and West (2013) found that students who entered middle school in sixth or seventh grade showed large drops in mathematics and writing achievement, which persisted through at least 10th grade. Boys and girls experienced similar drops in achievement after starting middle school. This decline in academic performance after entering middle school was most evident for students in urban settings, but was also significant for suburban and rural areas. These two studies demonstrate the need for concern for sixth- and seventh-grade students, but say little about eighth grade. They also focused on student-level effects and did not examine school-level outcomes or the impact of school-level demographics such as the racial/ethnic and socioeconomic composition of the school. Previous studies have documented the powerful influence of student demographics on school-level achievement (e.g., Hopson, Lee, & Tang, 2014; Sirin, 2005).

Eighth-grade studies

While sixth- and seventh-grade studies of academic achievement generally favor elementary schools, grade configuration studies examining eighth grade are fewer and have produced less clear results. Whereas the previously described longitudinal studies found that eighth-grade students in middle school underperform in comparison to eighth-grade students in elementary schools, other studies found no differences in eighth-grade achievement between the elementary and middle school configurations (Byrnes & Ruby, 2007; Weiss & Kipnes, 2006). Although eighth-grade students most commonly attend middle schools, approximately 17% of high schools in the United States also have eighth-grade students (National Center for Education Statistics, 2015). To our knowledge, only two studies have examined eighth-grade students in high schools. Using a nationally representative sample of about 2,700 students from the Early Childhood Longitudinal Study, Carolan, Weiss, and Matthews (2015) found no statistically significant association between eighth-grade mathematics achievement and grade configuration (e.g., Grades

K–8, 6–8, 7–12). In contrast, an older study using a primarily rural sample found that eighth-grade students in elementary schools performed better on achievement measures in comparison to those in middle schools (e.g., Grades 6–8) and junior/senior high schools (e.g., Grades 6, 7, or 8–12), with students in junior/senior high schools demonstrating the poorest academic performance (Wihry, Coladarci, & Meadow, 1992). Both of these studies suggest there is no benefit for eighth-grade students to be placed in a high school over elementary or middle school configurations.

The importance of school-level studies

The majority of grade configuration studies examined academic achievement at the individual student level (e.g., Rockoff & Lockwood, 2010, Schwerdt & West, 2013). While student-level analyses are important to identify associations between achievement and personal factors (e.g., student's special education status or financial background), government requirements in the No Child Left Behind (NCLB) Act and the Every Student Succeeds Act (ESSA) evaluate the functioning of schools as a whole. Under ESSA, over 50% of a school's accountability is comprised of school-level academic achievement outcomes (Every Student Succeeds Act, 2015). Accountability measures are used to determine how schools can improve student success as a whole, and can determine the level of state and federal funding received. Therefore, it is important to examine school-level achievement scores and to make comparisons between schools with different grade configurations.

Previous research indicates that school demographic variables influence academic achievement and other predictors of student success (Hopson et al., 2014; Klein & Cornell, 2010; Leithwood & Jantzi, 2009; Sutton & Soderstrom, 1999). For instance, school enrollment size has been negatively associated with student engagement and academic achievement in secondary school students (Holas & Huston, 2012; Leithwood & Jantzi, 2009). Low socioeconomic status has previously been linked to poorer academic achievement (Sirin, 2005; Sutton & Soderstrom, 1999). Additionally, schools with a high proportion of minority students have been found to have lower academic achievement (Hopson et al., 2014; Sutton & Soderstrom, 1999). Lastly, a nationally representative study found that urbanicity is associated with significant differences in academic achievement, with students in suburban schools having higher mathematics and reading achievement than students in urban and rural schools (Miller & Votruba-Drzal, 2015).

Present study

In 1995, Virginia became one of the first states to develop statewide curriculum standards and institute mandatory achievement testing for the purpose of school accountability and accreditation. The Virginia Standards of Learning (SOL) exams are administered starting in Grade 3 and continue through high school. The current study investigated state-mandated SOL exams for reading and mathematics in Grades 6, 7, and 8. We examined school-level pass rates separately for Grades 6, 7, and 8 in 573 public schools of various grade configurations. Pass rates were used as the outcome variables because schools are evaluated on the basis of passing rates rather than mean scores. Pass rates for sixth- and seventh-grade students in middle schools were compared to those in elementary schools, and

pass rates for eighth-grade students in middle schools were compared to those in high school configurations (there were insufficient numbers of schools with other grade configurations, such as eighth graders in elementary school).

Virginia has 133 public school divisions with each school division corresponding to a county or independent city. School divisions are led by elected school boards that serve Kindergarten through 12th-grade students and have considerable autonomy in deciding how to organize their schools. Most divisions use middle schools with Grades 6, 7, and 8, but some incorporate these grades into elementary schools (e.g., Grades K–7) and high schools (e.g., Grades 8–12). Decisions about grade configurations are based on judgments made by the school board about the most appropriate way to serve their students. For example, school divisions with smaller enrollment might use two rather than three schools to cover Grades K through 12. However, there is wide variation in school grade configurations across rural, town/suburban, and urban locales. For this reason, school demographic characteristics were assessed along with grade configuration.

One contribution of the present study is that our large and diverse sample of schools in rural, suburban, and urban locales across the state of Virginia allowed us to examine school demographic differences that may influence the relationship between grade configuration and academic achievement. For example, many of the previous grade configuration studies examined academic achievement differences in primarily urban locales (e.g., Byrnes & Ruby, 2007; Poncelet & Metis Associates, 2004; Rockoff & Lockwood, 2010). In addition to controlling for urbanicity, the analyses controlled for school enrollment size, percentage of minority students, and percentage of students eligible for free or reduced-price meals (FRPM).

A second contribution is that the study examined achievement scores over a 3-year period rather than from a single year in order the assess the consistency of findings over time. As expected, studies show that students demonstrate greater achievement gains when the content of standardized assessment closely aligns with the taught curriculum (Squires, 2009). Given that standards and achievement measures are frequently revised to reflect new practices, test performance may be affected after a revision while teachers are modifying their instruction to adapt to a new test or curriculum. A 3-year time sampling increases confidence that the findings are replicable and generalizable across years. The current study examined relations between grade configuration and achievement within years (intercepts) as well as across years (slopes) to account for changes in curriculum and other factors that may affect test performance in any given year.

Third, most previous studies examined a single grade (e.g., Grade 6 only) or conducted analyses that combined sixth- and seventh-grade students. Despite being commonly grouped together in the middle school setting, it is possible that sixth-, seventh-, and eighth-grade students may have better academic experiences in different configurations. To our knowledge, this study is the first to separately examine the relationship between grade configuration and academic achievement in all three middle grades. Lastly, whereas most studies compare students in middle schools to students in elementary schools, less is known about the academic achievement of students placed in high schools. Given that a significant proportion of high schools in Virginia include eighth grade, we examined differences in achievement between the middle and high school configurations. Our research questions were:

(1) Are sixth-grade mathematics and reading pass rates in middle school different from sixth-grade pass rates in elementary school?
(2) Are seventh-grade mathematics and reading pass rates in middle school different from seventh-grade pass rates in elementary school?
(3) Are eighth-grade mathematics and reading pass rates in middle school different from eighth-grade pass rates in high school?

Method

Sample

Analyses were conducted separately for sixth, seventh, and eighth grade. The sixth-grade sample consisted of 149 elementary schools (e.g., Grades K–6) and 270 middle schools (i.e., Grades 6–8). The seventh-grade sample included 323 middle schools and 34 elementary schools (e.g., Grades K–7). The eighth-grade sample contained 314 middle schools and 31 high schools (i.e., Grades 7 or 8–12). Sixth- and seventh-grade analyses did not include high schools, and the eighth-grade analyses did not include elementary schools due to an insufficient number of schools with those grade configurations. A small number of schools ($n = 11$) were not included in the study because student enrollment was fewer than 15 students per grade. These schools differed significantly from the schools in the analytic sample in multiple ways; the omitted schools had significantly smaller enrollments ($M = 179.4$ vs. $M = 748.0$ students per schools, $p < .001$), less ethnically diverse student populations ($M = 7.3\%$ vs. $M = 40.3\%$ racial/ethnic minorities, $p < .001$), and were located in sparsely populated areas ($M = 47.8$ vs. $M = 973.1$ average residents per square mile, $p < .001$).

School demographics are reported in Table 1. Overall, the 573 schools enrolled an average of 713 students (range 109 to 4,033), with 42% eligible for free or reduced-price meals (range 1% to 99%) and 44% of racial/ethnic minority background (range 0% to 99%). The average population density (number of people per square mile within each school division) was 1,502 people (range 9 to 9,314).

Measures

Academic achievement for the 2012–2013, 2013–2014, and 2014–2015 academic years was measured using school-level pass rates for the Virginia Standards of Learning (SOL) exams. The SOL exam scores and pass rates were obtained at the school level for sixth-, seventh-, and eighth-grade students for testing in English reading and mathematics. The web-based state-mandated exams measure student achievement in core classes at the end of each school year to assess whether students meet the minimum expectations indicated by state standards of learning. The SOL exams both fulfill state standards for accreditation and are in compliance with the federal requirements of the No Child Left Behind Act (Virginia Department of Education, 2015). For each exam, students receive a scaled score of 0 to 600, with 400 indicating a passing score and 500 indicating advanced proficiency in the subject.

The SOL exams are untimed and contain approximately 45 to 50 test items intended to assess student knowledge and skills related to the curriculum framework for four

Table 1. School-level demographics.

	Grade 6					Grade 7					Grade 8				
	Elementary		Middle			Elementary		Middle			Middle		High School		
	Mean	*SD*	Mean	*SD*	*t* test	Mean	*SD*	Mean	*SD*	*t* test	Mean	*SD*	Mean	*SD*	*t* test
FRPM[1]	37.54	24.84	43.38	20.99	−2.63**	56.53	13.58	42.69	20.96	5.31***	42.34	21.04	44.37	15.64	−.67
Total Enrollment	626.82	228.74	775.63	310.59	−5.90***	478.59	273.74	771.08	315.00	−5.84***	780.52	311.03	820.26	992.94	−.22
Percent Minority	48.42	28.08	43.72	26.33	1.80	21.45	25.82	42.97	25.79	−4.62***	43.61	25.53	16.41	17.90	7.71***
Population Density[2]	2,167.09	1,295.05	1,205.70	1,825.29	6.59***	726.89	1,859.15	1,067.14	1,593.77	−1.01	1,089.16	1,612.48	466.14	855.28	3.44***

*$p < .05$. **$p < .01$. ***$p \leq .001$.

Notes: In a few cases, schools did not report SOL scores for mathematics or reading for a particular grade or year, and were omitted from analyses. Therefore, sample sizes for mathematics and reading differ slightly across analyses.

[1]Percent of students in school eligible for free or reduced-price meals.

[2]Average number of residents per square mile within school division.

core areas, including English, mathematics, science, and history, as well as other areas including computer technology, fine arts, economics, and so forth. The state standards are reviewed and updated every 7 years. (State standards were updated in 2009 for mathematics and in 2010 for English reading.) In addition, test development experts and content specialists engage in a multi-phased item development process every year to assess content accuracy, grade-level appropriateness, and fairness of test items (Virginia Department of Education, 2015). New items that are approved by the Virginia Department of Education are then field tested during the spring test administration. Of the content areas described above, sixth-, seventh-, and eighth-grade students are required to take mathematics and English reading, and eighth-grade students also take English writing and science. The English reading exams primarily evaluate reading comprehension, and the math exams assess grade-specific proficiency in a multitude of content areas, including number sense, computation, geometry, probability, and algebra. Test items are primarily presented in multiple-choice format for English reading and mathematics. The mathematics exams also contain a small number of items with other types of response options, such as plotting points on a coordinate plane. Overall, the 2013–2014 and 2014–2015 reading and mathematics exams (the most recent available) demonstrated good reliability (Cronbach's alpha $\geq .83$) across gender and race for sixth, seventh, and eighth grade (Virginia Department of Education, 2014, 2015).

Procedure

School-level standardized test score data for the 2012–2013, 2013–2014, and 2014–2015 academic years were obtained for each school from the Virginia Department of Education (VDOE) website. The present study used pass rates in lieu of scaled scores given that schools are often held accountable based on standardized test pass rates. Analyses conducted using scaled scores yielded findings consistent with those of pass rates; however, we only report the results for pass rates given their policy relevance. School passing rates were for six Virginia Standards of Learning exams: Grade 6 reading, Grade 6 mathematics, Grade 7 reading, Grade 7 mathematics, Grade 8 reading, and Grade 8 mathematics. School demographics (percentage of students eligible for free and/or reduced-price meals, school size, percent minority students) for school year 2012–2013 were also obtained from VDOE public records. The population density for each school's attendance zone was obtained from U.S. census data (United States Census Bureau, 2012).

In order to study the differences in mathematics and reading pass rates over 3 years by school grade configuration, latent growth models were conducted for sixth, seventh, and eighth grade separately. For the sixth- and seventh-grade analyses, grade configuration was defined as 0 = elementary, and 1 = middle school. For the eighth-grade analyses, grade configuration was 0 = middle and 1 = high school. The factor loadings for the latent variable of intercept were fixed at 1 across all years. For the latent variable of slope, the factor loadings of pass rates in 2013, 2014, and 2015 were fixed at 0, 1, and 2, respectively. School demographic variables (percentage of students eligible for free and/or reduced-price meals, school size, percent minority students, and population density) for the year 2013 were introduced in the model as baseline covariates. All analyses

were conducted in *Mplus* 7.3. This study did not have individual test scores for students or classrooms, and therefore multilevel analyses were not conducted.

Results

Descriptive statistics were examined for all of the continuous predictors and the outcomes of mathematics and reading pass rates for the three years (Tables 1 and 2). Independent sample *t* tests revealed that school demographics varied significantly by configuration, though the trends differed for the sixth-, seventh-, and eighth-grade samples (see Table 1). In regard to SOL scores, significant differences in reading and mathematics pass rates were found across all three years for the sixth-grade sample. Fewer differences in reading and mathematics achievement were found for the seventh- and eighth-grade samples (see Table 2).

Preliminary analyses also included the examination of Pearson's product moment correlations among the continuous variables for sixth, seventh, and eighth grades (details available upon request). In general, reading and mathematics pass rates over the three years were highly correlated for each grade. Schools with higher percentages of minority students and students eligible for free or reduced-price meals tended to have lower pass rates for reading and mathematics. School size was positively correlated with higher pass rates, with some variation among the grades. Lastly, population density was negatively associated with pass rates for the seventh-grade sample for mathematics and reading across each of the years. There was no relationship between population density and pass rates for sixth grade, and the relationship for eighth grade was inconsistent across the three years.

Elementary school versus middle school

Sixth grade

Results of latent growth models are presented in Table 3. On average, sixth-grade students in elementary schools outperformed those in the middle schools on both reading ($\beta = -0.26$, $p < .001$) and mathematics pass rates ($\beta = -0.24$, $p < .001$) across all three years after controlling for school demographics. Across the three years, the pass rates for elementary schools were, on average, 6.9% higher for reading (78.9% vs. 72.0%) and 6.2% higher for mathematics (82.5% vs. 76.3%) than for middle schools. Higher prevalence of FRPM and percentage of minority students in the school were significantly linked with lower reading ($\beta = -0.74$, $p < .001$; $\beta = -0.13$, $p < .01$) and mathematics pass rates ($\beta = -0.47$, $p < .001$; $\beta = -0.16$, $p < .05$). Population density and school size were not significantly associated with reading ($\beta = -0.0002$, $p > .05$; $\beta = 0.02$, $p > .05$) or mathematics ($\beta = -0.05$, $p > .05$; $\beta = -0.16$, $p > .05$) pass rates. Grade configuration uniquely explained 6.3% and 10.5% of the variation in reading and mathematics pass rates, respectively. Moreover, grade configuration was not a significant predictor of slope, meaning that the relationship between grade configuration and pass rates did not change significantly across years.

Seventh grade

Results for seventh grade were similar to those for sixth grade. Seventh-grade students in elementary schools had significantly higher pass rates than those in middle schools

Table 2. School-level pass rates by year.

	Grade 6					Grade 7					Grade 8				
	Elementary		Middle			Elementary		Middle			Middle		High School		
	Mean	*SD*	Mean	*SD*	*t* test	Mean	*SD*	Mean	*SD*	*t* test	Mean	*SD*	Mean	*SD*	*t* test
2013 Reading Pass Rate	79.4	13.08	71.7	11.80	6.58***	73.7	9.90	74.2	11.71	−.258	70.3	12.48	66.5	10.49	1.91
2013 Mathematics Pass Rate	82.3	12.11	76.2	12.11	5.13***	60.3	19.47	53.0	19.94	2.06*	50.6	20.38	40.7	17.69	2.88**
2014 Reading Pass Rate	79.4	12.57	71.1	12.26	6.98***	72.6	10.36	75.3	11.30	−1.38	69.8	12.77	65.4	10.46	2.18*
2014 Mathematics Pass Rate	82.5	12.26	73.9	14.55	6.85***	63.3	16.55	58.4	19.42	1.78	56.4	19.80	53.3	20.05	.78
2015 Reading Pass Rate	83.0	10.27	74.6	11.16	8.17***	81.8	9.19	80.6	10.03	.75	74.9	11.44	74.4	7.12	.39
2015 Mathematics Pass Rate	86.1	9.61	81.1	12.03	4.99***	69.9	14.51	66.4	17.81	1.30	65.6	17.86	63.3	14.98	.78

*$p < .05$. **$p < .01$. ***$p < .001$.

Table 3. Latent growth model results.

	Grade 6		Grade 7		Grade 8	
	Reading	Math	Reading	Math	Reading	Math
Intercept						
Intercept	6.28***	6.77***	6.97***	3.46***	6.00***	2.66***
Population Density	−0.00	−0.05	−0.01	0.04	0.05	−0.05
FRPM	−0.74***	−0.47***	−0.79***	−0.64***	−0.79***	−0.30***
School Size	0.02	−0.07	0.02	0.01	0.07	−0.03
Percent Minority	−0.13**	−0.16*	−0.21***	−0.20**	−0.13*	−0.10
Grade Configuration	−0.26***	−0.24***	−0.70*	−0.22***	−0.11**	−0.17**
R2	0.81	0.41	0.80	0.54	0.76	0.15
Change in R2	0.06	0.11	0.01	0.05	0.07	0.03
Slope						
Intercept	0.66**	0.65**	1.67**	0.47	1.08**	1.22***
Population Density	0.06	−0.00	0.14	0.04	0.06	−0.08
FRPM	0.63**	0.30**	0.53**	0.28**	0.40*	0.13
School Size	0.14	0.19*	0.01	−0.02	−0.12	0.06
Percent Minority	−0.38**	−0.26*	−0.06	−0.17	−0.36*	−0.18
Grade Configuration	−0.16	−0.09	−0.01	0.23**	0.09	0.07
R2	0.20	0.05	0.29	0.09	0.26	0.05

*$p < .05$. **$p < .01$. ***$p < .001$.

Note: Grade configuration was coded as 0 = elementary and 1 = middle school for sixth and seventh grade; and 0 = middle and 1 = high school for eighth grade.

($\beta = -0.07$, $p < .05$; $\beta = -0.22$, $p < .001$). After controlling for school demographics, seventh-grade students in elementary schools had 2.7% higher pass rates for reading (78.5% vs. 75.9) and 14.0% higher pass rates for mathematics (83.1% vs. 69.2%) than in middle schools. Higher rates of FRPM and minority students were associated with lower pass rates for seventh-grade reading ($\beta = -0.79$, $p < .001$; $\beta = -0.21$, $p < .001$) and mathematics ($\beta = -0.64$, $p < .001$; $\beta = -0.20$, $p < .01$), whereas population density and school size were not significant predictors (p values > .05; see Table 3). Grade configuration uniquely explained 0.5% and 5% of the variation in reading and mathematics pass rates, respectively. Grade configuration was a significant predictor of slope for mathematics pass rates ($\beta = 0.23$, $p < .001$), but not for reading pass rates. In other words, the relationship between grade configuration and mathematics pass rates strengthened over time in the seventh-grade sample.

Middle school versus high school

Eighth grade

On average, eighth-grade students in middle schools had higher pass rates than those in high schools for reading ($\beta = -0.11$, $p < .01$) and mathematics ($\beta = -0.17$, $p < .01$) across all three years after controlling for school demographics. In comparison to high schools, middle schools had 4.6% higher pass rates for reading (74.7% vs. 70.0%) and 11.2% higher pass rates for mathematics (63.3% vs. 52.0%). Higher prevalence of FRPM in school was significantly associated with lower levels of eighth-grade reading pass rates ($\beta = -0.79$, $p < .001$) and mathematics pass rates ($\beta = -0.30$, $p < .001$). A higher percentage of minority students was associated with lower pass rates for reading ($\beta = -0.13$, $p < .05$). Again, school size and population density did not predict achievement (p values > .05). Grade configuration uniquely explained 7% and 3.4% of the variation in reading and mathematics pass rates, respectively. It was not a significant predictor of slope.

Discussion

The present study found that school-level pass rates for sixth- and seventh-grade reading and mathematics exams were consistently lower in middle schools than in elementary schools. Results were reliable across a 3-year sampling period, and after controlling for potentially confounding school demographics. These findings align with previous grade configuration studies that found lower academic achievement for sixth- and seventh-grade students in middle schools in comparison to students placed in elementary schools through at least seventh grade (e.g., Cook et al., 2008; Poncelet & Metis Associates, 2004; Rockoff & Lockwood, 2010).

For both sixth and seventh grade, reading pass rates were stable across the three years. For seventh-grade mathematics, however, statewide pass rates increased over the 3-year sampling period. One explanation for this trend may be due to the increased rigor of the mathematics exams following updates in state standards intended to promote college and career readiness (Virginia Department of Education, 2012). These findings highlight the importance of using multiple time samples because changes in standards and curricula will influence test performance (Squires, 2009). Overall, these results suggest that the commonly used sixth-through eighth-grade middle school configuration may not be the most suitable placement for sixth- and seventh-grade students.

Eighth-grade pass rates in middle schools were significantly higher than high school pass rates for both reading and mathematics. These results are in contrast to a study that found no significant differences in mathematics achievement for eighth-grade students in middle and high schools (Carolan et al., 2015). However, the previous study was based on student-level data from a large number of schools in multiple states averaging only 2.7 students per school, and used only one time point to assess achievement. Results from the current study are partially supported by an older school-level study that found that eighth-grade students in middle schools had higher achievement than eighth-grade students in high schools, though the study found that students in elementary school showed the highest achievement (Wihry et al., 1992).

Notably, the effect sizes for grade configuration on pass rates were the strongest for Grades 6 and 8. Effect sizes for reading were 6.3%, 0.5%, and 4.6% for Grades 6, 7, and 8, respectively. For mathematics, grade configuration accounted for 10.5%, 5%, and 11.2% of the variance in achievement for each of the respective grades. Sixth- and seventh-grade pass rates were highest in elementary configurations (e.g., Grades K–6 or 7), where most students have been in attendance for several years. For eighth grade, pass rates were highest in middle schools, where most students have been in attendance for nearly three years, in comparison to one or two years in the high school configuration (i.e., Grades 7–12 or 8–12). The smaller effect sizes for seventh-grade pass rates may be because, with few exceptions, seventh grade is not typically a transition year in Virginia. Seventh-grade students in middle schools, although still demonstrating weaker academic performance than those in elementary schools, have had more time to adjust to the new environment. These findings show some consistency with research concluding that students who change schools, regardless of whether the transition was compulsory (e.g., starting middle school) or non-compulsory (e.g., family move), show lower achievement growth the year immediately following the transition (Grigg, 2012).

The current study controlled for four school demographics: school size, urbanicity, school racial composition, and socioeconomic status (SES). Consistently across grades, schools with high numbers of students who qualified for free or reduced-price meals had lower achievement scores. These findings align with meta-analyses that identify a strong negative correlation between school-level socioeconomic status and academic achievement (Sirin, 2005). Additionally, schools in our sample with a high proportion of minority students also had lower achievement, consistent with another middle school study (Hopson et al., 2014).

Unlike other studies (Leithwood & Jantzi, 2009; Miller & Votruba-Drzal, 2015), neither urbanicity nor school size were associated with academic achievement in our sample. One reason for these findings may be that our study had a large and diverse sample of schools with a range of socioeconomic status and minority composition in both large and small schools from urban, suburban, and rural settings. This allowed us to distinguish effects of race and socioeconomic status from urbanicity and school size, which are often confounded in smaller samples, such as studies of urban school systems serving largely minority and low-income populations. Although U.S. Census data show that children in urban areas have higher poverty rates than children in more rural areas, in the state of Virginia, a large number of school systems are located in affluent urban locales (United States Census Bureau, 2016). Large-scale studies have found that urbanicity moderates the relationship between SES and achievement, though with varying outcomes. For example, one meta-analysis found that SES had the largest effects on achievement for suburban schools (Sirin, 2005), while results from a recent nationally representative study suggest that SES is most strongly correlated with achievement in urban locales (Miller & Votruba-Drzal, 2015). In sum, while the present study found a significant relationship between grade configuration and academic achievement notwithstanding demographic differences, it is important to recognize the effect of demographics on achievement.

One possible explanation for these findings is that the transition into a new school has detrimental effects on student achievement. Many researchers (e.g., Eccles et al., 1991; Simmons & Blyth, 1987) have blamed the developmental timing of the transition into middle school for poorer achievement and other negative outcomes. Early adolescence has been associated with a host of psychological and social-emotional difficulties, including the emergence of psychological disorders (Mendle, 2014; Merikangas, Nakamura, & Kessler, 2009), high rates of bullying (Nansel et al., 2001), less academic motivation (Goldstein et al., 2015), and low self-esteem (Robins & Trzesniewski, 2005). When directly compared to students in other grade configurations, middle school students report even lower self-esteem (Simmons & Blyth, 1987, Weiss & Kipnes, 2006) and higher rates of bullying and victimization (Anderman & Kimweli,1997; Malone, Cornell, & Shukla, 2017) than their same-grade peers, thus placing them at a disadvantage. It is possible that incurring a school transition during the middle grades may exacerbate the vulnerability that early adolescents typically experience, thus resulting in poorer academic engagement, motivation, and achievement.

It is also important to consider classroom factors associated with student achievement. In one grade configuration study, there was no direct association between sixth-grade school transition and academic achievement; however, classroom quality was indirectly associated with student academic achievement and perceived self-competence (Holas & Huston, 2012). Students with supportive teachers have higher academic achievement

and demonstrate greater effort and persistence, are more academically motivated, and are more engaged at school (Lee, 2012; Stroet, Opdenakker, & Minnaert, 2013). However, a recent statewide study of middle grade students in Virginia found no significant differences in perceived teacher support for middle grade students in elementary, middle, and high school grade configurations, indicating that middle school students perceive their teachers as equally supportive as students in other grade configurations (Malone et al., 2017).

Limitations and future directions

This study has several methodological limitations. First, this study is correlational in nature. For obvious reasons, students could not be randomly assigned to a specific grade configuration. Second, school divisions that choose to place their middle grade students in elementary and high school configurations may have other differences that were not measured in this study, such as higher quality teachers and administration, or more favorable school climates. Third, this study was unable to examine eighth-grade academic achievement in elementary schools because K–8 schools are an uncommon grade configuration in Virginia. Having this comparison group would have provided additional information about potential benefits of extending elementary school through the middle grades.

Though it is important to analyze student performance at the school level given that schools are held accountable based on school-level achievement, student-level test performance and demographic data can also be beneficial in recognizing student characteristics (e.g., socioeconomic status) associated with achievement gains or drops after a transition into a new school. Future studies may consider using both student- and school-level academic achievement. Multilevel models that account for the nesting of students within schools can provide important information about school-wide performance, and also how individual students perform before and after transitioning into a new school.

Another important direction for future study is to consider potential school-level mediators, such as school climate or teacher quality, that influence the relations between grade configuration and academic achievement. It is possible that middle schools with more favorable school climates or higher quality teachers have pass rates comparable to those in elementary or high schools. Finally, this study was concerned with test passing rates, which is a limited basis for comparing grade configurations. There may be other academic or social-emotional advantages to middle schools that were not considered in this study.

Conclusion and implications

The current study adds to the growing body of research that experiencing a school transition during early adolescence is associated with detrimental outcomes. While some studies show non-significant differences between grade configurations, to our knowledge there is no empirical evidence that shows negative outcomes for placing students in elementary schools through at least seventh grade. Although we were not able to examine eighth-grade achievement in elementary schools due to the limited number of elementary schools configured through eighth grade in the state of Virginia, previous

studies support the practice of limiting the number of school transitions for eighth-grade students, as well. We recommend that school administrators and other officials examine evidence-based practices for middle school reformation (Juvonen et al., 2004), and consider the possibility that the elimination of middle school is a viable option.

Acknowledgements

We thank members of the project research team including Anna Grace Burnette, Pooja Datta, Francis Huang, Joy Yuane Jia, Tim Konold, Jennifer Maeng, Patrick Meyer, and Shelby Stohlman.

Disclosure statement

No potential conflict of interest was reported by the authors.

Funding

This project was supported by Grant [2012-JF-FX-0062] awarded by the Office of Juvenile Justice and Delinquency Prevention and by Grant [NIJ 2014-CK-BX-0004] awarded by the National Institute of Justice, both of the Office of Justice Programs, U.S. Department of Justice. The opinions, findings, and conclusions or recommendations expressed in this report are those of the authors and do not necessarily reflect those of the U.S. Department of Justice.

Notes on contributors

Marisa Malone is a graduate student in the combined program in Clinical and School Psychology at the University of Virginia. Her research interests include school climate, academic achievement, and the prevention of violence in schools.

Dewey G. Cornell holds the Bunker Chair in Education in the Curry School of Education at the University of Virginia. His research interests include school climate and safety, bullying, threat assessment, and youth violence prevention.

Kathan Shukla is an assistant professor in Ravi J. Matthai Centre for Educational Innovation at the Indian Institute of Management Ahmedabad (IIM-A). His research interest includes applications of latent variable modeling techniques, development and validation of survey instruments, and social-emotional climate in schools.

ORCID

Marisa Malone http://orcid.org/0000-0001-5278-7894

References

Anderman, E. M. (2002). School effects on psychological outcomes during adolescence. *Journal of Educational Psychology*, *94*, 795–809. doi:10.1037/0022-0663.94.4.795

Anderman, E. M., & Kimweli, D. M. (1997). Victimization and safety in schools serving early adolescents. *Journal of Early Adolescence*, *17*, 408–438. doi:10.1177/0272431697017004004

Anderman, E. M., & Midgley, C. (1997). Changes in achievement goal orientations, perceived academic competence, and grades across the transition to middle-level schools. *Contemporary Educational Psychology*, *22*, 269–298. doi:10.1006/ceps.1996.0926

Byrnes, V., & Ruby, A. (2007). Comparing achievement between K–8 and middle schools: A large-scale empirical study. *American Journal of Education*, *114*, 101–135. doi:10.1086/520693

Carolan, B. V., Weiss, C. C., & Matthews, J. S. (2015). Which middle school model works best? Evidence from the Early Childhood Longitudinal Study. *Youth & Society*, *47*, 591–614. doi:10.1177/0044118X13478625

Cook, P. J., MacCoun, R., Muschkin, C., & Vigdor, J. (2008). The negative impacts of starting middle school in sixth grade. *Journal of Policy Analysis and Management*, *27*, 104–121. doi:10.1002/pam.20309

Dove, M. J., Pearson, L. C., & Hooper, H. (2010). Relationship between grade span configuration and academic achievement. *Journal of Advanced Academics*, *21*, 272–298. doi:10.1177/1932202X1002100205

Eccles, J. S., Lord, S., & Midgley, C. (1991). What are we doing to adolescents? The impact of educational contexts on early adolescents. *American Journal of Education*, *99*, 521–542. doi:10.1086/443996

European Commission/EACEA/Eurydice. (2017). *The structure of the European education systems 2017/18: Schematic diagrams. Eurydice facts and figures*. Luxembourg: Publications Office of the European Union.

Every Student Succeeds Act of 2015, Pub. L. No. 114-95 § 114 Stat. 1177 (2015–2016).

Goldstein, S. E., Boxer, P., & Rudolph, E. (2015). Middle school transition stress: Links with academic performance, motivation, and school experiences. *Contemporary School Psychology*, *19*, 21–29. doi:10.1007/s40688-014-0044-4

Grigg, J. (2012). School enrollment changes and student achievement growth: A case study in educational disruption and continuity. *Sociology of Education*, *85*, 388–404. doi:10.1177/0038040712441374

Holas, I., & Huston, A. C. (2012). Are middle schools harmful? The role of transition timing, classroom quality and school characteristics. *Journal of Youth and Adolescence*, *41*, 333–345. doi:10.1007/s10964-011-9732-9

Hopson, L. M., Lee, E., & Tang, N. (2014). A multi-level analysis of school racial composition and ecological correlates of academic success. *Children and Youth Services Review*, *44*, 126–134. doi:10.1016/j.childyouth.2014.05.026

Juvonen, J., Le, V.-N., Kaganoff, T., Augustine, C. H., & Constant, L. (2004). *Focus on the wonder years: Challenges facing the American middle school*. Santa Monica, CA: Rand.

Klein, J., & Cornell, D. (2010). Is the link between large high schools and student victimization an illusion? *Journal of Educational Psychology*, *102*, 933–946. doi:10.1037/a0019896

Larson, R. W., Moneta, G., Richards, M. H., & Wilson, S. (2002). Continuity, stability, and change in daily emotional experience across adolescence. *Child Development*, *73*, 1151–1165. doi:10.1111/1467-8624.00464

Lee, J.-S. (2012). The effects of the teacher–student relationship and academic press on student engagement and academic performance. *International Journal of Educational Research*, *53*, 330–340. doi:10.1016/j.ijer.2012.04.006

Leithwood, K., & Jantzi, D (2009). A review of empirical evidence about school size effects: A policy perspective. *Review of Educational Research*, *79*, 464–490. doi:10.3102/0034654308326158

Malone, M., Cornell, D., & Shukla, K. (2017). Association of grade configuration with school climate for 7th and 8th grade students. *School Psychology Quarterly*, *32*, 350–366. doi:10.1037/spq0000174

Mendle, J. (2014). Why puberty matters for psychopathology. *Child Development Perspectives*, *8*, 218–222. doi:10.1111/cdep.12092

Merikangas, K. R., Nakamura, E. F., & Kessler, R. C. (2009). Epidemiology of mental disorders in children and adolescents. *Dialogues in Clinical Neuroscience*, *11*, 7–20.

Miller, P., & Votruba-Drzal, E. (2015). Urbanicity moderates associations between family income and adolescent academic achievement. *Rural Sociology*, *80*, 362–386. doi:10.1111/ruso.12067

Nansel, T. R., Overpeck, M., Pilla, R. S., Ruan, W. J., Simons-Morton, B., & Scheidt, P. (2001). Bullying behaviors among US youth: Prevalence and association with psychosocial adjustment. *Journal of the American Medical Association*, *285*, 2094–2100. doi:10.1001/jama.285.16.2094

National Center for Education Statistics. (2015). *Table 216.10. Public elementary and secondary schools, by level of school: Selected years, 1967-68 through 2013-14*. Retrieved from https://nces.ed.gov/programs/digest/d15/tables/dt15_216.10.asp?current=yes

Nelson, E. E., Leibenluft, E., McClure, E. B., & Pine, D. S. (2005). The social re-orientation of adolescence: A neuroscience perspective on the process and its relation to psychopathology. *Psychological Medicine*, *35*, 163–174. doi:10.1017/S0033291704003915

Poncelet, P., & Metis Associates. (2004). Restructuring schools in Cleveland for the social, emotional, and intellectual development of early adolescents. *Journal of Education for Students Placed at Risk*, *9*, 81–96. doi:10.1207/s15327671espr0902_1

Robins, R. W., & Trzesniewski, K. H. (2005). Self-esteem development across the lifespan. *Current Directions in Psychological Science*, *14*, 158–162. doi:10.1111/j.0963-7214.2005.00353.x

Rockoff, J. E., & Lockwood, B. B. (2010). Stuck in the middle: Impacts of grade configuration in public schools. *Journal of Public Economics*, *94*, 1051–1061. doi:10.1016/j.jpubeco.2010.06.017

Schwerdt, G., & West, M. R. (2013). The impact of alternative grade configurations on student outcomes through middle and high school. *Journal of Public Economics*, *97*, 308–326. doi:10.1016/j.jpubeco.2012.10.002

Simmons, R. G., & Blyth, D. A. (1987). *Moving into adolescence: The impact of pubertal change and school context*. Hawthorne, NY: Aldine de Gruyter.

Sirin, S. R. (2005). Socioeconomic status and academic achievement: A meta-analytic review of research. *Review of Educational Research*, *75*, 417–453. doi:10.3102/00346543075003417

Squires, D. A. (2009). *Curriculum alignment: Research-based strategies for increasing student achievement*. Thousand Oaks, CA: Corwin Press.

Stroet, K., Opdenakker, M.-C., & Minnaert, A. (2013). Effects of need supportive teaching on early adolescents' motivation and engagement: A review of the literature. *Educational Research Review*, *9*, 65–87. doi:10.1016/j.edurev.2012.11.003

Sutton, A., & Soderstrom, I. (1999). Predicting elementary and secondary school achievement with school-related and demographic factors. *The Journal of Educational Research*, *92*, 330–338. doi:10.1080/00220679909597616

United States Census Bureau. (2012). *Virginia: 2010: Population and housing unit counts: 2010 census of population and housing* (Report no. CPH-2-48). Washington, DC: U.S. Government Printing Office.

United States Census Bureau. (2016, December 8). *New census data show differences between urban and rural populations* [Press release]. Retrieved from https://www.census.gov/newsroom/press-releases/2016/cb16-210.html

Virginia Department of Education. (2012, August 14). *2011–2012 math SOL results begin new trend line* [Press release]. Retrieved from http://www.doe.virginia.gov/news/news_releases/2012/aug14.shtml

Virginia Department of Education. (2014). *Virginia Standards of Learning Assessments: Technical Report 2013–2014 administration cycle*. Richmond, VA: Author.

Virginia Department of Education. (2015). *Virginia Standards of Learning Assessments: Technical report 2014–2015 administration cycle*. Richmond, VA: Author.

Weiss, C. C. & Kipnes, L. (2006). Reexamining middle school effects: A comparison of middle grades students in middle schools and K–8 schools. *American Journal of Education*, *112*, 239–272. doi:10.1086/498996

Wihry, D. F., Coladarci, T., & Meadow, C. (1992). Grade span and eighth-grade academic achievement: Evidence from a predominately rural state. *Journal of Research in Rural Education*, *8*(2), 58–70.