Title

Quality Instruction Matters: The Connection Between Student Engagement Antecedents and Assessment Outcomes

Authors

Christopher White, Ed.D., Central Michigan University
Greg Dionne, Ph.D., Central Michigan University
Joe Marr, Solomon Research & Analytics
William Sullivan, Solomon Research & Analytics

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Abstract

This study examines the relationship between instructional quality, student engagement, and standardized assessment outcomes within charter schools. Utilizing classroom observation data from 27 schools over two academic years, we construct an "Antecedents to Student Engagement" index, capturing key instructional strategies that foster student engagement. Employing Hierarchical Linear Modeling (HLM), we analyze the association between these instructional antecedents, student socioeconomic status (SES), and academic achievement as measured by the NWEA MAP assessment. Results indicate that higher engagement antecedents are significantly associated with improved academic outcomes, independent of SES. While SES remains a strong predictor of achievement, our findings suggest that schools emphasizing engagement-focused instructional practices mitigate disparities in student growth. These findings underscore the importance of integrating qualitative instructional measures into accountability frameworks to provide a more comprehensive evaluation of school effectiveness.

Introduction

School evaluation, particularly in the charter school sector, has evolved beyond standardized state assessments to encompass broader measures of success, including curriculum implementation, whole-child wellness, social-emotional development, student engagement, learning environment, and community impact. Despite this expansion, accountability frameworks often rely on summative, high-stakes assessments as primary indicators of effectiveness. These assessments, however, are frequently criticized for their strong correlation with socioeconomic status rather than instructional quality (Maroun & Tienken, 2024). Consequently, while they may provide insight into overall student performance, they fail to capture whether quality instruction is occurring or whether students are making meaningful academic progress toward proficiency.

For charter schools, where accountability is often tied to academic outcomes, the reliance on summative assessments presents a particular challenge. Many charter

school authorizers have introduced qualitative measures such as site visits and classroom observations to complement standardized benchmark assessments. However, these qualitative indicators are rarely systematically linked to quantitative academic outcomes, leaving a critical gap in understanding how instructional practices impact student achievement. This disconnect complicates efforts to both evaluate school effectiveness and provide parents with meaningful information for informed school choice (Dunk & Dickman, 2003; Stelle Garnett, 2021).

This study seeks to bridge that gap by examining the relationship between classroom observation data and student academic growth within a charter school authorizer in Michigan. Specifically, we investigate which elements of instructional engagement and classroom practice are most closely associated with standardized assessment performance while accounting for significant covariates such as socioeconomic status. By doing so, we not only highlight the importance of systematically evaluating instructional inputs but also provide a framework for developing more comprehensive accountability systems across all school types—public, charter, and private. If schools continue to rely solely on summative assessments as an "autopsy" of student performance, they risk perpetuating the same insufficient outcomes currently observed in national education data (National Center for Education Statistics, 2024). Instead, a more proactive approach to diagnosing instructional deficiencies and connecting good teaching to academic growth is necessary to drive meaningful improvements in student success.

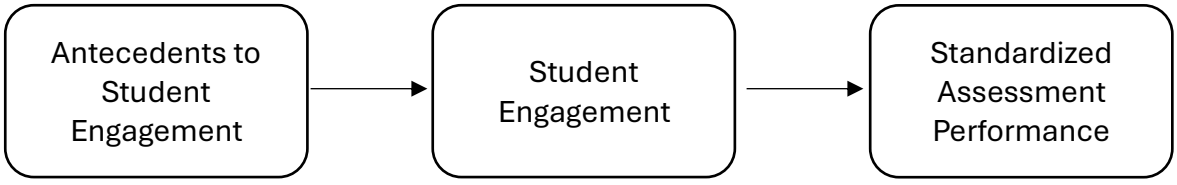
Literature Review

There are a few main themes that inform this research. First, student engagement is vital to students' academic outcomes. Second, and most relevant to this work, is that strategies employed in the classroom affect student engagement. The observational data collected for this paper is mainly along the lines of professional observations of the methods employed by teachers in their classrooms. The evidence base for this inquiry will focus on two things:

1. Student engagement is essential to student outcomes
2. Teacher strategies foster student engagement

Since teacher strategies foster student engagement, we have chosen to call these things “antecedents to student engagement.”

The theoretical framework for this study is that teachers use strategies in the classroom that foster student engagement. Secondly, the level of engagement that the student exhibits towards the content affects their performance on standardized assessments.



To connect these concepts together, as outlined in the theoretical framework, we will outline the existing evidence in two broad categories:

1. Student engagement and its impact on student outcomes
2. Antecedents to student engagement and its impact on student engagement and student outcomes.

For the purposes of this study, “student outcomes” is defined by a student’s performance on a standardized assessment.

Student Engagement

Previous research shows that student engagement is strongly related to academic achievement and growth (Hughes et al., 2008; Lei et al., 2018; Maamin et al., 2022). When engagement is diminished, opportunities to learn are lost, which has adverse cumulative effects on student outcomes (Quin, 2016). A student's time engaged academically strongly predicts academic achievement (Gettinger & Walter, 2012). A significant relationship exists between engagement and mathematics and ELA achievement (Downer et al., 2014; Guo et al., 2011; Maamin, et al., 2022). Students must actively engage in the classroom setting to see achievement results (Guo et al., 2011).

In attempting to define student engagement, there is a consensus that engagement comprises three distinct types: emotional, behavioral, and cognitive (Irvine, 2020; Maamin et al., 2022). Emotional engagement refers to students' reactions to other students and adults that lead to responses such as boredom, happiness, or anxiety. Cognitive engagement is a student's investment in learning complex ideas and concepts (Fredricks et al., 2004; Lei et al., 2018). Behavioral engagement is the level to which students participate in learning activities and the effort put forth while learning. Behavioral engagement is the most observable form of engagement and is often referred to as academic engagement (MI Student Voice, 2024).

Student engagement not only refers to whether students are on-task and doing what is asked of them but also whether they are intellectually active (Danielson, 2022). Classrooms with high engagement allow for student talk and are characterized by behaviors that show students are motivated to learn (Marzano, 2011). If educators pay attention to specific strategies for engagement, student attitudes toward instruction will improve, leading to better educational outcomes (Irvine, 2020).

Antecedents to Student Engagement

Certain conditions need to be met for engagement to occur. Engagement is more likely to occur in an environment that promotes safe and respectful relationships, has rigorous and clear learning expectations, and is conducive to diverse and active learning opportunities (Connell & Klem, 2006). Positive teacher-student interactions and student-student interactions are significant (Salmela-Aro et al., 2021). A respectful, supportive environment is a prerequisite to engagement (Pittaway, 2012).

Engagement is also more likely to occur if teachers use specific instructional strategies. Engagement is increased by using interactive teaching, facilitating active student responses, and providing frequent feedback. Instructional design is also important to engagement categorized by using a variety of teaching methods and matching instruction to student ability levels (Danielson, 2022; Hattie, 1992; Marzano, 2011). The strategies italicized below are all things that the classroom observers attempted to observe and score while collecting data associated with this research.

Classroom Environment & Teacher-Student Relationships

Teacher relationships predict a positive learning environment that directly influences student engagement (Konold, et al., 2018; Thornberg et al, 2020). Positive environments are characterized by teachers being sensitive to student needs, warm and nurturing teacher-student relationships, and student perspectives being considered (Reyes et al., 2012). Each interaction a teacher has with a student impacts the engagement level of that student in the future (Zeinstra et al., 2023). A classroom with positive teacher-student relationships will have a more positive overall learning environment which increases all three types of student engagement- cognitive, affective and behavioral (Wang, 2013).

Cognitive Challenge & Rigor

Cognitive rigor is the extent to which classroom instruction demands students to use critical thinking skills. A rigorous school environment allows students to participate in activities requiring knowledge transfer and sets high expectations for all students (Blackburn, 2008). Setting high standards is an essential component of rigor and a necessary instructional strategy for student engagement (Pittaway, 2012). Educational experiences must be challenging and enriching, and students' academic abilities must be extended to engage (Zepke & Leach, 2010). When the level of thinking becomes more rigorous in a classroom, the percentage of students engaged in instruction increases (Paige, 2013). Rigor must also be accompanied by teacher support and intervention to see the most significant effects on student engagement (Downer et al., 2014).

Student Talk, Questioning & Discussion

Student talk is an essential strategy that can lead to higher levels of student engagement. Talk can be defined as teachers explaining and questioning but encouraging student talk and big-picture communication (Goodwin et al., 2021). Questioning and discussion are most effective at increasing engagement when the teacher promotes dialogue among students or authentic audiences (Lee & Hannafin, 2016). Collaboration and fostering learning relationships in the classroom facilitates engagement (Zepke & Leach, 2010).

Active Learning: Ownership of Learning & Differentiation

Active learning has been shown to improve student engagement (Chi & Wylie, 2014; Hopper & Brake, 2018). It also allows a higher level of knowledge retention because

learners can activate and integrate new knowledge iteratively and collaboratively to increase retention of the new knowledge (Chi & Wylie, 2014). Compared to more traditional, lecture-style pedagogy, active learning can increase student achievement and reduce failure rates (Freeman et al., 2014). Bonem et al. (2020) found that active learning positively predicted course grades.

Active learning is also categorized by learning, where students take ownership of how they learn. This promotes autonomous motivation (Lee & Hannafin, 2016). Students must take responsibility for their learning to be fully engaged (Cochran et al., 2016; Pittaway, 2012). When students are working autonomously, there must be specific goals they are attempting to achieve to know what learning goals they are taking responsibility for (Lee & Hannafin, 2016). Students who work autonomously feel more competent about achieving objectives and have a greater self-belief, which leads to greater engagement in future activities (Zepke & Leach, 2010). The byproduct of teachers allowing agency in learning is intrinsic motivation, leading to more engagement in the future (Pendergast & Kaplan, 2015).

Scaffolding

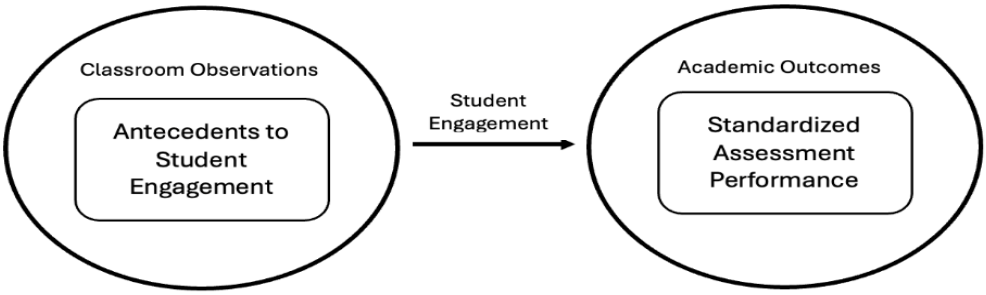
Scaffolding is the instructional strategy of providing student-centered support. In this process, students are given just enough support to be successful and then move on to the next goal. The teacher monitors progress frequently but then provides procedural, conceptual, or strategic support. By providing this kind of support, students experience success and become more engaged with future activities (Lee & Hannafin, 2016).

Additional Antecedents Related to Engagement

For engagement to take place, several other factors influence the level of engagement and create the situation in which engagement can occur. Teacher instructional strategies and activities enhance engagement, including the use of authentic tasks, opportunities for collaboration, and time for fun (Fredricks et al., 2004). Although external family and community factors can also impact levels of engagement, teacher influence is the best predictor and can mitigate those factors (Quin, 2016).

The observational data collected in this study consists of professional observations of the methods employed by teachers in their classrooms. After analysis, teaching strategies that lead to student engagement, referred to in this paper as antecedents to student engagement, emerged as an important theme. We have focused on these antecedents to student engagement and its relationship to academic outcomes.

The conceptual framework for this study begins with the use of classroom strategies, or antecedents to student engagement, which foster student engagement. The level of engagement that the students exhibit towards the content affects their performance on standardized assessments.



Research Questions

This study draws on literature that links classroom practices to student engagement and achievement. It also relies on the theoretical concept that certain instructional strategies, referred to as "Antecedents to Student Engagement," foster increased student engagement, resulting in improved performance on standardized assessments. The study aims to address the following research questions:

1. **To what extent do the observed antecedents of student engagement correlate with standardized assessment outcomes in reading and mathematics at the school level?**
   This question examines whether a higher overall score on the engagement-focused observational rubric (such as evidence of student-centered teaching, active learning, scaffolding, and rigorous questioning) is linked to improved student performance on the NWEA MAP assessment.

2. **How does socioeconomic status (SES) interact with these instructional practices in predicting student achievement?**
   Since SES has long been recognized as a strong predictor of academic performance, we aim to determine whether schools with high levels of Antecedents to Student Engagement can mitigate—or worsen—SES-related achievement gaps. Specifically, we examine if students from lower SES backgrounds benefit equally from these engagement-centered practices.

3. **Do the relationships between student engagement antecedents and student outcomes vary when accounting for initial student achievement?**
   By evaluating both end-of-year achievement (spring scores) and growth (fall-to-spring gains), we investigate whether schools that focus on student engagement strategies make greater progress over time than what baseline achievement levels would predict.

By addressing these questions, the study seeks to determine how systematic observation and measurement of classroom strategies can enhance our understanding of student engagement and contribute to the development of more comprehensive accountability systems that recognize qualitative aspects of instruction alongside quantitative indicators of academic success.

Data and Samples

During the 2021-2022 and 2022-2023 School Years, a charter school authorizer in Michigan conducted classroom observations of 27 schools from its portfolio. These observations are conducted primarily in the year preceding a school's reauthorization.

The number of classrooms observed within each school ranges from 3 to 102 (median = 26.) Grade levels range from kindergarten to grade 12. Classroom observations covered multiple subjects; however, emphasis was placed on ELA and Mathematics. Trained observers with a background in K-12 teaching observed each class for approximately 20-50 minutes. Scores ranging from 1 to 4 (1 = Below Expectations, 2 = Approaching Expectations, 3 = Meets Expectations, 4 = Exceeds Expectations) were assigned to 24 sub-categories belonging to 5 domains according to the prescribed rubric. The rubric for assigning scores is similar to the Danielson Framework for Teaching and the Marzano Teacher Evaluation Model. A subset of these categories was chosen to represent the antecedents to student engagement outlined in the study's conceptual model.

School Level Variables – Antecedents to Student Engagement

We construct an Antecedent to Student Engagement index from the subgroups extracted from the observations. Each construct has a scale of 1 to 4, as outlined above. Each component defines what it means to meet expectations (a 3 on the scale) (Table 1). Values for each component are summed across observers, and then an average of observers within the school is taken as the index score.

Standardized Assessment Data

NWEA's MAP Assessment measured student-level mathematics and Reading achievement in the fall and spring. MAP is a nationally normed, standardized achievement test delivered via a computer adaptive model that adjusts to a student's skill level. Scores are scaled to a Rausch Unit Interval (RIT score). Each school administers tests in a fall and spring test window to students in grades 3 through 8. The spring score represents the achievement level at the end of the school year, while the Fall score is used in the growth model to control for the achievement level at the beginning of the school year.

Additional Covariates

Socioeconomic Status (SES)

Information from the Michigan Student Data System (MSDS) on a student's eligibility for the Supplemental Nutrition Assistance Program (SNAP) is merged with the achievement data. It provides a measure of student-level socioeconomic status (SES.) In the original data, a binary indicator of true (or 1) indicates that the measure is reverse-coded so that higher values indicate higher socioeconomic status.

Analytic Sample

There are 21 schools in the analytic sample. Grade levels within the school had approximately the same number of students, but the number of students within each school varied (39, 514, median = 221). The sample includes 5,763 students. As Table 2 indicates, the students included in the sample have lower SES than public school students in Michigan but slightly higher SES than other students who choose charter schools in Michigan. In Michigan, charter schools serve more students with limited English proficiency and more minority students.

Methods

We use Hierarchical Linear Modeling (HLM) to model our nested data (students within schools.). HLM is often employed to address modeling issues, such as aggregation bias, misestimation of errors, and the unit of analysis problem arising from nested data (Raudenbush & Bryk, 2002). We modeled both achievement and growth. We fit an achievement model to our data that uses the spring score from our assessment as an outcome and employs student SES, school-level SES, and school-level student engagement scores as covariates. We fit this model for outcomes in Mathematics and Reading separately. Second, we fit a growth model that employs the same outcome variable but includes the fall NWEA score of each student as a student-level covariate.

Following Enders & Tofighi, 2007, we center the student-level SES around the group mean. This allows us to study cross-level interactions. We also grand-mean-center both school-level SES and our school-level measure of the antecedents to student engagement. This allows our intercept to have a more meaningful interpretation. Grade level is a set of indicator variables, with 5^{th} grade omitted as the base.

First, we estimated a null model with no covariates. The null model estimates the overall between-school variance in the outcomes. From this, we calculate an intra-class correlation (ICC), which can be interpreted as the proportion of the variance in achievement between schools. Tables 3 and 4 show that the ICC is 0.26 and 0.31 for Reading and Mathematics, respectively. The overall intercept should be interpreted with grade levels in mind. The NWEA MAP Assessment is a vertical scale. We expect students to score higher in 8^{th} grade than in 3^{rd} grade. We also control for student-level SES by including our group-mean-centered indicator.

At the school level, we include a grand-mean-centered average of SES within the school. Further, we include an interaction term between our student- and school-level SES measures. Also, at the school level, we include an average of the school's antecedent to student engagement score. This is our central measure of interest. However, we are also interested in the interaction of these student engagement antecedents and socioeconomic status. Therefore, we interact the student-level SES indicator with our school-level measure of student engagement. Finally, our growth model includes students' fall scores as a predictor of their spring scores.

Discussion

In both subjects, higher student-level SES is associated with increased mean achievement. As expected, school-level SES has a positive coefficient. However, the estimates for school-level SES are not statistically significantly different from zero. Grade level is associated with the expected differences from our base level of 5th grade.

Our main interest is in the coefficients for the Antecedents to Student Engagement. This association with mean achievement is large in both subjects. Schools with higher average scores on this index have significantly higher mean achievement in the Spring of the school year.

We also model two interaction effects. The first is a school-level interaction between SES and Student Engagement. This coefficient is not statistically significantly different from zero. The second is a cross-level interaction of student-level SES and our school-level measure of Student Engagement. This coefficient is significant and positively associated with higher mean achievement. This implies that higher student-level SES is associated with higher mean achievement to an even greater degree in schools with higher Antecedent to Student Engagement scores. This suggests that students in schools focusing on the Antecedents to Student Engagement benefit more if they are of higher SES. Our Growth models shed more light on this.

Our growth model is identical to our achievement model except for adding students' fall scores to predict their spring scores. The coefficient for fall scores is 0.93 and 0.83 for mathematics and ELA, respectively. This implies that a 1 unit increase in the fall score means a slightly lower than 1 unit increase in the spring score, on average. By adding the fall score, we can examine the association of SES and student engagement antecedents while controlling for these differences in where students began the year academically.

As in our achievement model, student-level SES positively correlates with spring scores. In addition, school-level student engagement levels are positively associated with spring scores. What has changed is the interaction of student-level SES and school-level student engagement. There is no longer an interaction effect when we control where a student begins the school year. This implies that the association of student engagement with student growth applies to all students regardless of their socioeconomic status.

Summary

School evaluation has shifted from focusing on standardized testing to including qualitative measures as well. A quality education and the measure of that quality is important for all types of schools but is especially important in the school choice space. Measures of student engagement have received attention as one way of determining

the quality of instruction. This study does not measure student engagement directly, but instead uses an observation tool that determines the quality of the Antecedents of Student Engagement. Our work demonstrates that these Antecedents are positively associated with strong student outcomes as measured by standardized tests. This study reinforces the critical role of instructional quality in shaping student engagement and academic achievement.

Further, closing the socioeconomic achievement gap has been a primary goal of educators, education researchers, and policymakers. One promise of school choice has been to do a better job at closing that gap. We have shown that student growth associated with student engagement impacts all students regardless of socioeconomic status. To close achievement gaps, educators and policymakers must focus on those factors that benefit all students. Our findings highlight that while socioeconomic status remains a strong determinant of academic performance, engagement-focused teaching practices can drive student growth regardless of socioeconomic background.

Future research should explore how classroom indicators of high-quality instruction can be further refined and connected to other educational outcomes such as standardized tests. By shifting focus from standardized tests alone, school leaders and policy holders can shift away from a summative only process to a more proactive, growth model for school improvement.

Tables

Table 1.

Description of the Antecedents to Student Engagement	
Student Centered	Observed instruction was primarily student-centered, with opportunities for students to demonstrate learning.
Active Learners	The teacher provides opportunities for students to discuss content, collaborate with other students, or reflect on their own learning.
Pace	The observer judged that the pace of the lesson was appropriate for student learning.
Prior Knowledge to the Real World	The teacher must consistently connect the learning objective to a student's prior knowledge of the real world.
Academic Questions	The teacher must pose academic questions that deepen academic understanding and encourage elaboration on content or examination of reasoning.
Academic Discussions	Students should be consistently encouraged to engage in substantive academic discussions and make connections to prior or future learning.
Interventions and Supports	The teacher provides specific interventions or additional supports within general instruction.
Scaffolding	The teacher provides intentional scaffolding at a deliberate pace to progress students toward independence (I do, We do, You do).

Table 2.

Analytic Sample – Population Comparison				
	Sample Size (n)	% SES	% LEP	% White
Sample	5,763	69.6%	12.9%	33.2%
State Charter Schools	150,486	78.0%	12.0%	32.5%
All State Public Schools	1,429,895	56.0%	7.0%	64.3%

Table 3.

	Null Model			Mathematics Achievement			Mathematics Growth		
Coeffcient	*Estimates*	*Conf. Int (95%)*	*P-Value*	*Estimates*	*Conf. Int (95%)*	*P-Value*	*Estimates*	*Conf. Int (95%)*	*P-Value*
Intercept	205.89	201.19 – 210.58	**<0.001**	204.76	200.18 – 209.33	**<0.001**	22.38	19.34 – 25.41	**<0.001**
Student Engagement (School)				20.98	11.96 – 30.01	**<0.001**	4.02	1.33 – 6.70	**0.003**
SES (School)				7.95	-8.43 – 24.34	0.341	0.96	-3.99 – 5.91	0.704
SES (Student)				2.95	1.81 – 4.09	**<0.001**	0.68	0.10 – 1.26	**0.021**
Grade [3]				-14.18	-15.43 – -12.93	**<0.001**	3.17	2.50 – 3.84	**<0.001**
Grade [4]				-6.44	-7.70 – -5.17	**<0.001**	1.07	0.43 – 1.70	**0.001**
Grade [6]				5.27	4.00 – 6.53	**<0.001**	-0.28	-0.91 – 0.35	0.382
Grade [7]				11.36	10.04 – 12.68	**<0.001**	-0.34	-1.02 – 0.33	0.318
Grade [8]				14.78	13.43 – 16.13	**<0.001**	-1.81	-2.52 – -1.10	**<0.001**
Student Engagement x SES-School				11.77	-49.33 – 72.87	0.706	-4.45	-23.07 – 14.17	0.639
Student Engagment x SES-Student				6.17	3.29 – 9.05	**<0.001**	0.25	-1.22 – 1.73	0.737
Fall							0.93	0.91 – 0.94	**<0.001**
Random Effects									
σ^2	304.27			206.71			50.76		
τ_{00}	135.83 $_{District\_Code}$			33.08 $_{District\_Code}$			2.67 $_{District\_Code}$		
τ_{11}				1.28 $_{District\_Code.ses.c}$			0.34 $_{District\_Code.ses.c}$		
ρ_{01}				1.00 $_{District\_Code}$			0.76 $_{District\_Code}$		
ICC	0.31			0.14			0.05		
N	24 $_{District\_Code}$			24 $_{District\_Code}$			24 $_{District\_Code}$		
Observations	5763			5763			5763		
Marginal R^2 / Conditional R^2	0.000 / 0.309			0.435 / 0.514			0.873 / 0.880		

Table 4.

	Null Model			Reading Achievement			Reading Growth		
Coeffcient	*Estimates*	*Conf. Int (95%)*	*P-Value*	*Estimates*	*Conf. Int (95%)*	*P-Value*	*Estimates*	*Conf. Int (95%)*	*P-Value*
Intercept	202.94	198.84 – 207.03	**<0.001**	203.09	198.96 – 207.21	**<0.001**	38.47	35.35 – 41.60	**<0.001**
Student Engagement (School)				20.29	12.16 – 28.42	**<0.001**	5.01	2.59 – 7.42	**<0.001**
SES (School)				7.82	-6.84 – 22.49	0.296	-2.14	-6.25 – 1.97	0.307
SES (Student)				3.13	1.95 – 4.30	**<0.001**	1.05	0.32 – 1.79	**0.005**
Grade [3]				-13.94	-15.22 – -12.67	**<0.001**	1.55	0.78 – 2.31	**<0.001**
Grade [4]				-5.64	-6.94 – -4.35	**<0.001**	0.83	0.09 – 1.56	**0.027**
Grade [6]				5.24	3.95 – 6.54	**<0.001**	-0.13	-0.86 – 0.60	0.734
Grade [7]				10.24	8.89 – 11.58	**<0.001**	0.56	-0.21 – 1.34	0.154
Grade [8]				12.95	11.57 – 14.32	**<0.001**	-0.56	-1.37 – 0.24	0.171
Student Engagement x SES-School				-5.96	-60.69 – 48.78	0.831	0.93	-14.54 – 16.39	0.907
Student Engagment x SES-Student				5.05	2.06 – 8.04	**0.001**	0.62	-1.30 – 2.55	0.526
Fall							0.83	0.82 – 0.85	**<0.001**
Random Effects									
σ^2	299.92			215.56			67.91		
τ_{00}	103.15 $_{\text{District\_Code}}$			26.76 $_{\text{District\_Code}}$			2.20 $_{\text{District\_Code}}$		
τ_{11}				1.51 $_{\text{District\_Code.ses.c}}$			1.03 $_{\text{District\_Code.ses.c}}$		
ϱ_{01}				1.00 $_{\text{District\_Code}}$			1.00 $_{\text{District\_Code}}$		
ICC	0.26						0.03		
N	24 $_{\text{District\_Code}}$			24 $_{\text{District\_Code}}$			24 $_{\text{District\_Code}}$		
Observations	5763			5763			5763		
Marginal R^2 / Conditional R^2	0.000 / 0.256			0.410 / NA			0.819 / 0.825		

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