Testing the Impact of Student Engagement on Standardized Achievement: An Empirical study of the Influence of Classroom Engagement on Test Scores across School Types

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Abstract

This paper considers the relationship between student achievement on standardized tests and the nature and levels of student engagement in Missouri public elementary, middle, and high schools. Student engagement data from 105 elementary, 68 middle schools and 79 high schools in nine professional development regions of Missouri were considered. We postulated that both higher-order, non higher-order engagement, and teacher and student disengagement would impact student achievement levels and that the extent of the relationship may not be the same for higher-order, non higher-order, and disengagement. Findings affirm the influence of teacher and student disengagement and higher-order student engagement levels on student achievement, as measured by state high-stakes assessments. These findings bring light to the consequences of teachers' pedagogical practices and provide reasonable prognostication of future standardized achievement levels based upon changes in the nature and levels of student and teacher engagement within schools. As theorized, influence was disparate, with higher-order student engagement enhancements yielding marginal increases in standardized achievement while teacher and student disengagement detrimentally impacted student learning at more pronounced rates. Additionally, the influence of student engagement upon standardized performance levels varies across school type. The elementary and middle schools included in the study exhibited nearly identical disengagement/engagement-to-achievement relationships, whereas a more pronounced engagement effect at the high school level strongly suggests the prospect of wider test score fluctuations that parallel the engagement fluctuations. As a result, school leaders and policymakers should note that targeting and altering engagement at all grade levels will not be translated into uniform gains and declines on standardized achievement tests at each level.

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Fair or not, public schools are judged based upon their students' test school performance. School districts now undertake painstaking efforts to monitor and evaluate their standardized achievement. Far too few school administrators and teacher leaders are aware of the vital role student engagement plays in influencing standardized achievement levels in the high-stakes testing environment. As administrative teams and faculty begin to appreciate the importance of assessing the nature and level of teacher and student engagement within their classrooms, they too can learn to more aptly identify and hone their pedagogical practices. By its very nature, the Instructional Practices Inventory (IPI) process of profiling student engagement fulfills a diagnostic function by allowing faculties to learn of the current profile of student engagement within classrooms across the school. More importantly, the IPI provides the foundational framework to promote intra-faculty discussions and development that facilitate building-wide refinement and growth of those practices, including the stimulation of higher-order student engagement while suppressing student and/or teacher disengagement.

Organizational Learning at the School Level

Faculty learning that can result in building-level growth in educational best practices must be considered at the elementary, middle, and high school building levels. Common features of effective schools can be gleaned from the literature (Wilson, 2007). For instance, it is in effective schools that school leaders prioritize the curricular and instructional objectives for the school. The research appears to suggest that initially focusing on achieving modest, yet demonstrable gains within the first twelve months of the change effort is advisable (Cohen, 2007). In the current accountability era, schools can afford to dedicate neither the time nor the effort to loose experimentation with curricular practices in their attempts to best and most effectively educate students.

Effective school initiatives can be successfully introduced within schools largely because such schools are evolving organizations, rather than static institutions that are unable to change (Bolman & Deal, 2003). Effective schools are not a pre-existing institutional phenomenon.

Instead, organizations must gather institutional knowledge, and organizational leaders must incorporate such knowledge into desirable procedural routines. Hence, an inextricable nexus might exist between organizational learning and effective schooling.

There is no singular or otherwise terse means by which to characterize organizational learning. Organizational learning ultimately involves the accumulation of meaningful knowledge over time. This knowledge can be applied more productively and to the benefit of the organization if it is widely diffused throughout the entire organization (Buchel & Probst, 2000). The appropriate processes and structures for exacting organizational learning and change demand more than robotic routines based on organizational information. Instead, argue Fiol and Lyles (1985), "organizations can be designed to encourage learning and reflective action-taking, but this generally means moving away from mechanistic structures" (p. 805).

Such organizational learning can be enhanced by data collection and reflection (Skretta, 2007). The interpretation of the data gathered and knowledge gleaned amounts to a condition whereby "data are given meaning" (Daft & Weick, 1984, p. 286). It is organizational learning that allows for schools to evolve toward those desirable instructional practices which will ensure that all children are sufficiently challenged and prepared to succeed throughout their formal schooling and in their subsequent occupational endeavors. Assessing the nature and vigor of student learning in schools is an important component of improving school performance. Skretta (2007) suggests the need and importance of classroom walkthroughs that are conducted with continuous regularity.

Data collection within schools is a highly desirable enterprise that is both requisite for, and a byproduct of, school-wide organizational learning. It can be largely instructive for teachers to have access to data that capture the level of student learning occurring within their buildings (Skretta, 2007). The importance of those organizational members that are subordinate to the top leadership, such as teachers, must not be discounted; however, as Lane and Lubatkin (1998) argue that an organization must "devote at least as much attention to managing its capabilities as it does to managing its assets" (p. 474). Teachers' assessments of their students' learning are prone to fallacy, as teachers can mistake student engagement in varied activities for actual academic progress (Skretta, 2007). As a result, there exists the need for classroom observations that provide teachers with accurate and relevant data on both the quality of instruction (Skretta, 2007) and the quality of students' classroom engagement in learning (Valentine, 2005; 2009). Indeed, the importance of data reflection within schools has been well documented, and district-led data sessions can serve to inform schools of their current instructional practices (Valentine, 2005; 2009). The interpretation, incorporation, and execution of information depend largely on leadership objectives and the extent to which leaders prioritize the importance of information that can stimulate organizational learning and change initiatives. The organizational leaders, according to Daft and Weick (1984), can formulate operational responses that are predicated on such information. As school leaders incorporate instructional data into their faculty discussions, these teachers and administrators can form decisions about how to best proceed in improving teacher instruction, and subsequently, student engagement and learning (Valentine, 2005; 2009).

Classroom Student Engagement

Thinking lacks a singular definition, as technical skills, strategic thinking, and conceptual understanding are all important cognitive processes (Greeno, 1997). The current challenge for teachers is not simply to teach thinking, but rather to teach good thinking (Nickerson, 1988). Students should be given access to classrooms where learning to think thrives (Greeno, 1997). Furthermore, students should be encouraged to introspectively reflect upon the learning process itself (Nickerson, 1988). Currently, however, some 80-95% of classroom work has been found to be derived from published instructional material (Cooper, 1989). While this appears to be a most expeditious way of preparing students for high-stakes testing, it may fail to enhance students' critical thinking and reasoning abilities.

The education researcher would be hard pressed to advance an empirically justifiable argument against the importance of encouraging teachers to stimulate heightened levels of student critical thinking within the classroom. Before considering how to best stimulate critical thinking in classrooms, it is important to first determine what constitutes student critical thinking. There exists an abundance of literature that principally focuses on the critical thinking of elementary and secondary school students. While a consensus exists among education scholars that critical thinking is a desirable skill for students to possess, whether such a skill can be directly taught or otherwise imparted to students remains more contested. Weast (1996), citing Logan (1976), notes that "students can learn to think more 'critically, logically and scientifically if they [take] coursework having that task as an explicit goal' (Weast, 1996, p.189). Both the curriculum and the instructional practices of curricular delivery will ultimately dictate whether students learn to think critically. Perhaps more importantly, the philosophy that underpins both a school's curriculum initiatives and teaching philosophy will also impact the extent to which students are active, engaged learners or whether teachers instead resort to the more rote memorization activities that traditionally encapsulate standardized test preparation (Cotton et al., 1989; Henderson et al., 2005). Ultimately, teaching students to simply memorize content strategies only teaches them what to think rather than how to think (Weast, 1996, citing Logan 1976). It is important for school leaders to ultimately stress to their faculties that "absorbing knowledge and critical thinking are not mutually exclusive" endeavors (Weast, 1996, p. 193).

Educators oftentimes fail to make concerted efforts to encourage active student thinking when presenting students with factual content, despite research that demonstrates that students benefit greatly from engaging in reflective thinking and critical judgment (Geertsen, 2003). Such critical thinking on the part of students involves "…thinking about your thinking while you're thinking in order to make your thinking better" (Geertsen, 2003). As teachers incorporate critical thinking into the curriculum, their doing so ensures that students remain intellectually stimulated and challenged, and also equips students to become open-minded and evidence-minded citizens (Geertsen, 2003). School curriculum that acknowledges that "all children are eminently educable" will be more likely to encourage critical thinking instruction for public schoolchildren (Druian & Butler, 1987, p. 7). The challenge, of course, will be to negotiate an appropriate balance between ensuring that students possesses sufficient levels of content knowledge, while also demonstrating that they are able to process such knowledge critically.

Students can engage in varying degrees of critical thinking. An advanced form of critical thinking that is termed "higher-order/deper thinking" incorporates desirable aspects of complex student learning, such as abstraction, extrapolation, and conceptual synthesis (Geertsen, 2003; Lewis, 1978; Underbakke, Borg, & Peterson, 1993). Higher-order thinking is an important intellectual enterprise for all learners. It is imperative that teachers not simply didactically convey factual information to students because, whether on standardized tests or in their professional lives, they will be forced to think critically and creatively (Geertsen, 2003). Higher-order thinking can be equated with a more exacting form of critical thinking (Cotton, et al., 1989; Lewis, 1978, Underbakke, Borg, & Peterson, 1993). Lewis (1978) constructs a useful definition of higher-order thinking, in which he suggests that "higher-order thinking occurs when a person takes new information and information stored in memory and interrelates and/or rearranges and extends this information to achieve a purpose or find possible answers to perplexing situations" (Lewis 1978, p. 136). Such critical and higher-order thinking processes are not innate or readily embraced student practices. Instead, effective teachers who provide instruction to high achieving students have been found to be more likely to engage their students in critical thinking and problem solving (Brophy, 1990).

Higher-order thinking is desirable not simply for the benefit derived by students as they are challenged within the classroom. As importantly, students who are instilled with the desire to critically inquire or otherwise interrogate their greater worlds will serve to benefit the wider society with more valuable forms of human capital. A notable relationship exists between the level of human capital within a nation, which can be greatly determined by the quality of instruction students receive, and the extent to which that nation enjoys economic progress (Pritchett & Filmer, 1997). Not surprisingly, therefore, policymakers and politicians pressure schools to produce maximum levels of human capital.

Standardized Test Achievement

State education policymakers' approaches to compliance with AYP vary considerably. The average test performance levels of students in a particular grade are the most common form of accountability data (Phelps & Addonizio, 2006). Simply focusing on the change in a student population's test performance over multiple years can be a flawed indicator of students' intellectual growth, however (Phelps & Addonizio, 2006). Data that also enable school leaders to identify effective instructional practices that occur within a given classroom and to replicate such practices throughout the entire school might be of greater usefulness to school leaders (Cooley, Shen, Miller, Winograd, Rainey, Yuan, et al., 2006).

Educational leaders within school districts will remain illiterate in how to best broach accountability reform efforts if they are unfamiliar with data processing and analysis (Cooley et al., 2006). This unfamiliarity with the accountability terrain, in which well-intentioned school administrators simply become overwhelmed by the exacting accountability demands, can foster low-levels of principal self-efficacy, as gleaned by increased perceptions of their limitations in survey and interview responses. Depressed levels of self-efficacy, in which administrators question their ability to accomplish educational objectives, can also prove to be a dangerously self-fulfilling prophecy (Anderson et al., 2006). Ultimately, the extent to which such an accountability environment affects school variables such as efficacy is pertinent to the current study, as mean standardized test scores have been found to vary significantly across schools based upon multiple school variables (Anderson et al., 2006).

It is commonly thought that the simultaneous objectives of providing students with adequate and appropriate test preparation, while also teaching students critical thinking and learning skills, cannot both be coherently incorporated into a single curriculum (Weast, 1996). Such perceptions are not groundless, as the NLCB legislation and the accompanying accountability fervor, have constrained the curricular options of school administrators. While pre-packaged curricula that are tightly aligned with accountability standards leave less slack for incorporating new curricular initiatives, teaching students critical thinking skills can compliment test preparation practices. A certain foundational knowledge is required for successful thinking, as students' cognitive structures must be congruent with the actual concepts that are to be learned (Greeno, 1997). The act of thinking is a knowledge-rich enterprise, and involves interaction between processes and knowledge (Nickerson, 1988). Student acquisition of the appropriate procedures and strategies for applying knowledge in problem solving and reasoning requires more than simple factual recall (Greeno, 1997).

Designing a curriculum solely around standardized test preparation simply teaches students what to think, whereas engaging students in rich and demanding intellectual inquiry will teach them how to think, both on tests and outside the classroom (Weast, 1996). Weast (1996) asserts that "absorbing knowledge and critical thinking are not mutually exclusive" (Weast, 1996, p. 193). As students engage in intellectual discovery and problem formulation, they can learn how to more aggressively problem-solve (Greeno, 1997).

The pronounced disparity in resources and the abilities of a student population suggest that absolute comparisons between schools or school districts based solely on test scores oversimplifies potential differences in the quality of education that students receive across districts and the demonstrated progress of these school districts over time (Rumberger & Palardy, 2005). Rumberger and Palardy (2005) note that included among the often-studied variables within achievement models are student composition, school sector, financial resources, and test scores. Heck (2001) further suggests that "the utility of performance tests would be enhanced if they could be shown to be less sensitive to variables that schools cannot control, while being more sensitive to schools' curricular and instructional practices" (p. 23).

Methods: The IPI Instrumentation

The Instructional Practices Inventory (IPI) process is a system for codifying student engagement throughout the school for a specified period of time, typically a school day, and then implementing a study protocol by the faculty to collectively and collaboratively study the data and allow that study to inform instructional design and the process of learning in the classrooms of the school. The IPI is comprised of "a set of observational categories complex enough to provide substantive data grounded in the knowledge of best practice (valid) yet easily understood and interpreted" (Valentine, 2010). The IPI instrumentation allows a trained classroom observer to collect scores of observational codes that capture student engagement behaviors for a school. The observation categories included in the IPI observation protocol are: (1) student disengagement, (2) student engagement in non higher-order activity without teacher engagement or support of learning, (3) student engagement in non higher-order activity with teacher engagement and support, (4) teacher-directed/teacher-led instruction, (5) student engagement in higher-order, verbal learning conversations, and (6) student engagement in independent and/or non-verbal higher-order learning.

The IPI process focuses on student engagement and cognitive thinking rather than teacher or student behavior. The codes are "not about the instructional activities in which students are engaged, but about how students are ‘cognitively engaging’ during the instructional activity. The IPI profile data can be used to foster teacher engagement in whole-faculty and small-group collaborative analysis, reflection, and decision-making of the profile data. The IPI instrumentation, and the accompanying building-level instructional processes, can ultimately provide telling and comprehensive school-wide data that allow teachers and administrators to continuously monitor and refine their pedagogical practices. These components of the IPI process support continuous change and collectively foster organizational learning (Valentine, 2009).

Undoubtedly there exists a multitude of factors whose impact on student learning are noteworthy. This exploratory study was designed to glean the extent to which student engagement levels may or may not lead to demonstrable gains in standardized achievement performance of public school students. The study is constructed in a manner whereby the researcher is able not only to offer dichotomous “yes/no” conclusions about such a relationship, but also to expound on the magnitude with which different forms of student engagement ultimately impact students’ abilities to perform at or above the proficiency levels of the Missouri Assessment Program (MAP) standardized tests.

One of the more complex methodological challenges presented by the present study is not formulaic in nature, but rather involves the adequate and accurate definition of student engagement levels and what constitutes higher-order, non higher-order thinking and teacher and student disengagement. Such attempts to delineate meaningfully nuanced distinctions between various types of student engagement can quickly become obscured and fruitless if student engagement behaviors are hyper-parsed, and categorized as such. The Instructional Practices Inventory strikes a methodologically appropriate balance between meaningfully categorizing student engagement without deconstructing the classroom environment to such an extent that coding the minutia of student behavior becomes an untenable task for the classroom observer. More importantly, as the categories become more numerous (and indistinguishable), the reliability of such classroom observations can become greatly diminished. With this in mind, the Instructional Practices Inventory codifies student engagement into six categories that account for the spectrum of engagement that one can expect to find in any given classroom at a particular moment.

Figure One is an explanation of each of the six coding categories. It is important to note that while the higher-order categories ("5" and "6") represent desirable forms of student learning whereas the student and teacher disengagement categories ("1" and "2") represent less effective and generally undesirable, indefensible forms of engagement, it is not always possible, nor desirable, for students to be engaged solely in higher-order activities. As such, non higher-order categories "3" and "4" account for those productive learning moments during classroom instructional time when the teacher is primarily involved in informing and directing the students' activities in the classroom, even though student engagement is generally more cognitively, physically, and emotionally passive.

Insert Figure 1: IPI Category Descriptions approximately here

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FINDINGS:

The descriptive data for the elementary, middle, and high schools in this study are presented in Tables One, Two and Three, respectively. In all, data for the 105 elementary schools, 68 middle schools, and 79 high schools were used to ascertain whether standardized achievement outcomes were disparately impacted according to school type. Pass rates for standardized achievement levels across school type were relatively uniform, with score ranges of 39-45%. Striking differences in the student engagement coefficient on the standardized achievement outcomes serve as a telling metric by which to quantify the disparate impact that student engagement exacts upon standardized achievement levels.

Insert Table One: Level I Elementary School Descriptive Data approximately here

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Insert Table Two: Level I Middle School Descriptive Data approximately here

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Insert Table Three: Level I High School Descriptive Data approximately here

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Findings

Contained in Tables A and B of the Appendix are the data outputs for the three-level and the two-level HLM models that tested the student engagement-achievement relationships for elementary, middle, and high schools. The computational results for mathematics and communication arts achievement levels with the nature and level of student engagement across elementary, middle and high school types are provided in Table Four. The relationships were not tested in isolation, as the student demographic, funding, and community variables were tested in the models for the data profiled in Tables One through Three. More specifically, the first level of both the two-level and three-level output charts provided the coefficient values of the percentage of teachers with master's degrees (tchr-mas), the student teacher ratio (stu-tchr), the percentage of minority students (pct-min) and the percentage of students eligible to receive free-and-reduced lunch (FRL).

Insert Table Four: Projected Increases/Decreases in Engagement

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Interestingly, the vast majority of models tested contained student engagement independent variables whose coefficient magnitudes were found to be statistically significant ($p<.05$). For student disengagement in core classrooms (C1) for instance, in the three-level model elementary and high schools exhibited an identical slope magnitude of -.59 on communication arts achievement, whereas the value was a more depressed -.44 for middle schools. The relationship of all higher-order thinking levels (T56) on mathematics achievement was found to be less robust in elementary schools (.14) than it was in high schools (.21) on the three-level model. No statistically significant relationship was evidenced at the middle school level.

Models' Variance Explanation

Tables Five, Six and Seven contain variance findings associated with the elementary, middle, and high school HLM models. Especially interesting are the differences that emerge not only across school type, but also between communication arts and mathematics performance. At the elementary school level, a 45-55 percent variance apportionment was common, suggesting that 45% of variation in communication arts test performance is attributable to between school differences while the remaining 55% is explicable based upon district level differences. For elementary school mathematics, that common variance distribution was 35-65, with 35% of mathematics achievement explained by across-school differences, while the other 65% rests in district-level distinctions.

Insert Table Five: Elementary School Variance

At the middle school level, communication arts achievement variance was generally a 35-65% level across school/across district mixture. Remarkably, however, mathematics achievement variance for middle schools was almost entirely accounted for at the school level (90%), while only 10% of mathematics achievement variance associated with across-district variance. The variance apportionment was even more extremely skewed for high schools with approximately 80% of communication arts achievement variance associated with across-school distinctions and 20% attributed to across-district differences. As for mathematics achievement variance at the high school level, fully 95% of variance was explained by across school differences, while the remaining 5% was accounted for at the district level.

Insert Table Six: Middle School Variance

Insert Table Seven: High School Variance

Ultimately, no readily identifiable pattern emerges across school type or between content area tested within the school type. Mathematics variance, for instance, is faintly attributable to across district disparities at the middle and high school level (no greater than 12%), while it averages nearly 65% for elementary schools. The researcher will avoid advancing speculatively shallow postulations on these findings. It will instead be noted that district-level initiatives that are more intensively crafted, executed, and monitored at the central office level could be determinative in shaping test performance levels among some school types in some content areas, while it remains the case for most schools and content areas tested that building-level initiatives will retain the greatest test score explanatory power.

A Realistic Application of the Findings

The essence of the overall IPI process parallels the methodology of this study quite coherently. That is, after an initial IPI data collection, school leaders immediately become aware of their school's current student engagement profile in raw percentage terms. Quantifying student engagement behaviors is not only diagnostically meaningful, but presents the opportunity for more healthy and constructive goal setting at the building level. Indeed, school leaders are then empowered to chart a more data-driven course for their faculties. The designated benchmarks, in turn, will augment standardized test passage rates according to the findings fleshed out below.

School administrators should approach the use of the IPI with an embrace for teacher empowerment. An administrator's aimless and arbitrary pursuit to accrue declines in non higher-order and disengaged learning and gains in higher-order learning could lead to faculty dissent, confusion, and/or a lack of faculty-wide buy in to the collaborative learning process. Instead, a faculty developed and evolving set of goals for higher-order thinking levels enables school leaders, including teacher leaders, to more purposefully, confidently, and competently attack lagging higher-order student engagement levels. While the optimal level of total disengagement is, of course, zero percent, faculty members are also wise to appreciate the devastating effect that ballooning student disengagement levels can exact on both teacher morale and standardized achievement levels.

To provide an illustrative example of how easily a school can encounter spikes in higher levels of disengagement, consider that all public schools are preoccupied with attaining the rigidly prescribed AYP targets. A faculty can diligently craft the proper curriculum and convey it to students with rigor and relevance. Problematic in the NCLB era, however, is the extent to which standardized test objectives corrode the teacher's effective use of instructional time. Continued moderate, unanticipated drift toward disengagement may lead to a shift from the relatively typical 5% student disengagement level (Category 1) to a more disconcerting 15% in short order. Indeed, such a pattern is most conspicuously manifested in low-achieving schools. Without realizing the issue at hand, a school can easily be forfeiting the cumulative equivalent of more than 25 school days (five weeks) of lost learning time when the disengagement level reaches 15% in a 175 day school year.

Looking at the issue from another angle, a 15% rate of disengagement equates in our study to standardized performance declines of 3.8% - 4.7 % in Math and 4.7% - 6.9% in Communication Arts. Even extreme efforts to offset the disengagement with heightened levels of higher-order, deeper thinking would require enormous effort. For each raw percentage gain of disengagement, our study data imply the need for a corresponding 3-4 percentage point increase in higher-order, deeper learning to maintain the existing level of standardized achievement. This underscores how critical it is for school leaders to continuously study and address their school-wide levels of engagement.

Also important is the temporal design of the IPI process. The IPI process is not a quick fix or shock treatment meant to remedy all that ails a school's instructional health instantaneously. Instead, the IPI process demands from faculties a sustained commitment to altering their pedagogical techniques and practices over a sustained time horizon. It is in this vein that school leaders can view the student engagement benchmarks; not as a punitive or heavy-handed oversight metric, but as attainable building-level guideposts that signify faculty growth, commitment, and instructional excellence. Presently, for instance, higher-order student engagement average levels hover around 20% of all student classroom learning time as measured by the IPI process. Enhancing the present level of higher-order thinking to a considerably more ambitious 60% of all student classroom time could seem to be an unduly formidable obstacle for a school's faculty. Likewise, such growth could also require an exceptionally forceful probing from a nervously reluctant principal and/or central office administrator. Viewing the 40% gap in current and optimal higher-order thinking levels over a multi-year time span fundamentally simplifies the process. As a result, altered for the better are the students' learning experiences, their capacity to become “thinkers” as learners for life, and the capacity of the school to become a learning organization.

It is also vitally important that school leaders stress that such quarterly gains are not an indefinitely defined journey. Indeed, mapping out a multi-year, incremental plan can become cumulative in nature, with periodic standardized achievement gains of 2.5% - 5%. As such, faculty morale would swell, pedagogical techniques would become noticeably more expert, collaborative conversations supporting pedagogical strategies would become more pronounced and this transformative effect would provide the requisite propulsion needed to thrust the school’s higher-order thinking levels on a steady incline. Such is the potential value of a focus on engagement in a school that is achieving organizational learning.

Computed Projections of Impact

Projected relationships between levels of engagement and student achievement on high-stakes tests were computed for this manuscript. The computations are presented in Table Four. The top number in each cell is the projected pass rate percentage on the state high stakes test. The bottom value in parentheses is the slope from the statistically significant two-level and three-level results. To translate these findings into meaningfully interpretable data for school practitioners, policymakers, and researchers, the student engagement coefficients were realistically manipulated by multiplying the figures by plausible fluctuation levels for those relationships found to be statistically significant in the two-level and three-level HLM results.

More specifically, the researchers computed the differences between the schools’ current levels of student disengagement (IPI Category 1) and student lower-level engagement when the teacher was not attentive to, supportive of, or engaged with the students (Category 2) and a 25% upper boundary, a student and teacher disengagement rate present in many schools with particularly low achievement on state assessments. Computations were also made for higher-order/deeper thinking reflecting an upper boundary goal of 60%, a level clearly associated with higher rates of student achievement. Such benchmarks represent a threshold of disengagement that is dangerously elevated and the bounds for higher-order thinking that would more closely approximate a school that exhibits continuous faculty study of their engagement data and growth exemplifying organizational learning.

The results of the computations produced highly compelling findings. Were student disengagement across all classrooms (IPI Category T1) to increase from their current average levels up to 25% of all coded observations, Communication Arts proficiency level pass rates would be impacted to a remarkably similar extent in both elementary and high schools (12.72 and 11.72 percentage point declines, respectively). The results between elementary and middle schools were nearly identical when student disengagement in core classrooms (Category C1) were tested in the two-level model for Communication Arts proficiency levels (10 point losses in both educational settings). High school student achievement for Communication Arts was impacted to a more noteworthy extent, with a resultant 13.68 percentage point loss. The findings associated with non higher-order student engagement with simultaneous teacher disengagement in all classrooms (Category T2) were significant for both elementary and high schools. There, Communication Arts pass rates would decline by 4.91 percentage points and 6.06 percentage points, respectively. In a like manner, a decline in Communication Arts of 4.14 percentage points would also be projected if the percent of Category 2 in core classes was to increase to the 25% threshold. In the three-level HLM model, Communication Arts at the elementary and high school levels were dramatically impacted, as they were in the two-level model with projected declines in achievement of 12.72 and 13.68 percentage points respectively as the total disengagement (Category T1) rose to 25%. Also in the three-level model, the projected impact of student non higher-order engagement with the teacher not engaged (Category C2) was a robust 11.34 for both the elementary and high schools if Category 2 became 25%, a level often commensurate with low student achievement on state assessments. The projected comparable finding for middle schools was a slightly lower, yet still powerful, 9.17 percentage point impact. For the total student disengagement, teacher not engaged (Category T2), the findings were also the same in the three-level model for elementary and high school at a 5.75 percentage decline in achievement.

The influence of higher-order student engagement projections in core classrooms (Categories C5 and C6 combined) on achievement presented in Table 4 were computed for a change in achievement from typical levels of 20% to a more optimal 60% from the two-level and three-level HLM models. The impact of higher-order thinking on Communication Arts proficiency pass rates was greatest in the high school three-level model (9.04 percentage point increase), although the elementary and middle schools gains were also strong (5.81 and 7.93 percentage points, respectively) from the significant findings in the two-level model. A noteworthy gain of 6.36 percentage points was also evident in the two-level model for all higher-order engagement (Categories T5 and T6 combined).

Fewer significant findings were available to project achievement results from the Mathematics models, compared to the Communication Arts models. The findings, however, provide pertinent insights. Student disengagement in core classrooms (IPI Category C1), for instance, would be more perniciously impacted in middle schools than in high schools (9.78 and 7.54 percentage point declines, respectively) based upon data from the two-level model. In the three-level model, the relationship between all student engagement in lower-order learning when the teacher is not attentive to, engaged with, or supportive of the students (IPI Category T2) projects to a 4.11 percentage point loss in achievement if the levels of T2 rise to the 25% level.

The higher-order student thinking independent variables yielded relationships to the Mathematics proficiency dependent variables that were also evidenced in the Communication Arts models. Indeed, when higher-order thinking across all classrooms (IPI Categories T5 and T6 combined) are augmented to 60% of all coded classroom observations, student achievement level pass rates on the state assessment increased by 5.56 and 8.52 percentage points on the Mathematics component of the state assessment (in elementary and high schools, respectively) given the findings in the two-level model. Similar results were yielded for higher-order student engagement in core classrooms (Categories C5 and C6 combined), with gains of 4.26 and 8.88 percentage points pass rates in elementary and high schools across Missouri per the two-level model results. The statistically significant projected gains for IPI categories T56 and C56 (total and core higher-order) in the three-level model were 5.96 and 4.65 in Mathematics at the elementary level.

Discussion

Accountability Era Concerns

Undeniably, public education systems now find themselves entrenched in a policy environment of standardization. Mandates and directives meted out by the federal government most commonly assume a one-size-fits-all form. Findings from this study strong suggest that the No Child Left Behind Act’s uniform treatment of school types as being created equal is fundamentally flawed. For most statistical tests for this study, high school standardized achievement levels were most impacted by classroom student engagement levels. This finding illustrates that the battle school faculties wage to ensure all their students demonstrate proficiency requires more aggressive efforts at the high school level.

Ultimately, our findings illustrate the gulf in standardized score declines that would result when student disengagement within schools are enhanced from their current levels to 25%. Communication Arts achievement would decline 10.63 in middle school and 13.68 points in high schools when the disengagement was measured across all core classes (C1). In a like manner, achievement in math would decline 7.54 pass rate points in high schools and 9.79 pass rate points in middle schools when disengagement in core classes reached the 25% level. The extent to which non higher-order thinking more greatly impacts standardized achievement is consistent across all school types. As such, the diligent school leader will take note of the fact that non higher-order student disengagement levels impact standardized achievement levels at four times the rate of higher-order student engagement levels.

Standardized Test Acumen

Our findings also reveal apparent dissimilarities in the extent to which higher-order student engagement affected standardized achievement More specifically, were higher-order student engagement levels in all classrooms ("T56") to increase from their current levels to a more optimal 60%, mathematics gains of 5.56 in Elementary Schools and 8.52 percentage points High Schools would accrue. Communication Arts findings, on the other hand, were not statistically significant across school types. While a complete explanation of this finding escapes the authors, we believe it is not overly speculative to rely upon critical thinking and higher-order engagement research. Noteworthy is the demonstrated relationship between such classroom behavior and the formation of student skill-sets and competencies that students can rely upon not only when sitting for standardized tests, but when "real-world" problem solving capabilities are needed. Consequently, faculty pedagogy that is transformed in a manner that stimulates student classroom engagement that is more active, abstract, and critical has wide-reaching effects. Students are able to more capably synthesize and apply these higher-order capabilities to the content-area subject matter, the results of which include a greater mastery of problem solving techniques that make even the toughest standardized test instruments more manageable for the students.

Organizational Appropriateness

It is, of course, beyond the scope of this paper to explore why the “cookie cutter” approach to public education is lauded in policy circles while it is eschewed by private sector management. At the very least, our study offers empirical evidence that public schools warrant tailored and site-specific improvement initiatives. It must be abundantly clear that our findings do not provide the basis to advocate a “run our schools like businesses” approach to school improvement. Organizational theoreticians that have written extensively above private sector organizational improvements do appear to be largely vindicated by our findings, however. More specifically, detached and highly centralized directives that are bereft of an on-the-ground feel for the problems that confront administrators and faculties would naturally be expected to exhibit a disparate impact on the overall outcomes of such organizations. In this instance, the organization is either the public elementary, middle, or high school. Left for another day is research involving administrator empowerment to implement and effect change initiatives at the site level. For now, it should be noted that the differences across school types remained consistently larger for high schools, despite less differences across each type of school. As a result, school leaders should take note of findings that suggest that while high school standardized achievement performance levels appear to be more impacted by student engagement levels, all three school types evidence significant standardized achievement fluctuations based upon the corresponding student engagement levels.

Figure One: ***Instructional Practices Inventory Category Descriptions***

Student Active Engaged Learning (6)	Students are engaged in higher-order thinking and developing deeper understanding through analysis, problem solving, critical thinking, creativity, and/or synthesis. Engagement in learning is not driven by verbal interaction with peers, even in a group setting. Examples of classroom practices commonly associated with higher-order/deeper Active Engaged Learning include: inquiry-based approaches such as project-based and problem-based learning; research and discovery/exploratory learning; authentic demonstrations; independent metacognition, reflective journaling, and self-assessment; and, higher-order responses to higher-order questions.	**Student Engagement in Higher-Order Deeper Learning**
Student Verbal Learning Conversations (5)	Students are engaged in higher-order thinking and developing deeper understanding through analysis, problem solving, critical thinking, creativity, and/or synthesis. The higher-order/deeper thinking is driven by peer verbal interaction. Examples of classroom practices commonly associated with higher-order/deeper Verbal Learning Conversations include: collaborative or cooperative learning; peer tutoring, debate, and questioning; partner research and discovery/exploratory learning; Socratic learning; and, small group or whole class analysis and problem solving, metacognition, reflective journaling, and self-assessment. Conversations may be teacher stimulated but are not teacher dominated.	
Teacher-Led Instruction (4)	Students are attentive to teacher-led instruction as the teacher leads the learning experience by disseminating the appropriate content knowledge and/or directions for learning. The teacher provides basic content explanations, tells or explains new information or skills, and verbally directs the learning. Examples of classroom practices commonly associated with Teacher-Led Instruction include: teacher dominated question/answer; teacher lecture or verbal explanations; teacher direction giving; and, teacher demonstrations. Discussions may occur, but instruction and ideas come primarily from the teacher. Student higher order/deeper learning is not evident.	**Student Engagement in Knowledge and Skill Development**
Student Work with Teacher Engaged (3)	Students are engaged in independent or group work designed to build basic understanding, new knowledge, and/or pertinent skills. Examples of classroom practices commonly associated with Student Work with Teacher Engaged include: basic fact finding; building skill or understanding through practice, "seatwork," worksheets, chapter review questions; and multi-media with teacher viewing media with students. The teacher is attentive to, engaged with, or supportive of the students. Student higher-order/deeper learning is not evident.	
Student Work with Teacher not Engaged (2)	This category is the same as Category 3 except the teacher is not attentive to, engaged with, or supportive of the students. The teacher may be out of the room, working at the computer, grading papers, or in some form engaged in work not directly associated with the students' learning. Student higher-order/deeper learning is not evident.	
Student Disengagement (1)	Students are not engaged in learning directly related to the curriculum.	**Students Not Engaged**

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Note: The Instructional Practices Inventory categories were developed by Bryan Painter and Jerry Valentine in 1996. Valentine refined the descriptions of the categories in 2002, 2005, 2007, and 2010.

Table One: Level One Descriptive Statistics for Selected Demographic, Achievement, and Engagement Variables – Elementary Schools

Variable Name	N	Mean	SD	Minimum	Maximum
TCHR_MAS	105	48.20	16.30	6.70	87.00
FRL	105	52.52	19.38	11.20	95.00
PCT_MIN	105	18.34	27.66	0.00	100.00
STU_TCHR	105	17.98	3.33	5.00	25.00
COMM_ARTS	105	43.56	10.23	4.00	71.80
MATH	105	43.76	12.44	1.00	68.20
AVG_T1	105	3.07	3.52	0.00	20.00
AVG_T2	105	6.13	4.99	0.00	21.00
AVG_T5	105	5.39	4.56	0.00	18.00
AVG_T6	105	14.89	8.74	0.00	46.50
AVG_C1	105	2.89	3.63	0.00	20.00
AVG_C2	105	6.16	5.54	0.00	24.50
AVG_C5	105	6.12	6.70	0.00	53.00
AVG_C6	105	15.15	9.17	0.00	46.50

Table Two: Level One Descriptive Statistics for Selected Demographic, Achievement, and Engagement Variables - Middle Schools

Variable Name	N	Mean	SD	Minimum	Maximum
TCHR-MAS	68	49.76	14.16	16.90	74.80
FRL	68	44.75	16.57	16.20	85.90
PCT_MIN	68	18.74	24.87	0.00	100.00
STU_TCHR	68	17.62	2.87	5.00	23.00
COMM_ARTS	68	43.98	10.80	12.60	63.10
MATH	68	44.73	12.53	7.80	64.70
AV_T1	68	4.55	3.52	0.00	16.50
AV_T2	68	10.33	5.95	1.00	34.50
AV_T5	68	4.31	3.46	0.00	17.00
AV_T6	68	15.36	7.22	2.00	38.00
AV_C1	68	4.16	3.36	0.00	16.50
AV_C2	68	10.42	6.39	0.00	34.50
AV_C5	68	4.61	3.58	0.00	16.67
AV_C6	68	14.32	7.38	1.00	33.00

Table Three: Level I Descriptive Statistics for Selected Demographic, Achievement, and Engagement Variables – High Schools

Variable Name	N	Mean	SD	Minimum	Maximum
TCHR_MAS	79	42.51	13.68	8.90	71.40
FRL	79	39.19	15.59	13.60	79.30
PCT_MIN	79	11.73	20.46	0.30	99.70
STU_TCHR	79	19.39	4.62	9.00	33.00
COMM_ARTS	79	39.94	10.67	4.00	61.80
MATH	79	39.90	13.66	0.00	73.50
AV_T1	79	5.78	5.31	0.00	28.00
AV_T2	79	9.46	5.32	0.00	25.00
AV_T5	79	4.57	3.36	0.00	15.00
AV_T6	79	14.86	8.80	0.00	46.50
AV_C1	79	5.17	5.38	0.00	28.00
AV_C2	79	9.37	5.61	0.00	25.00
AV_C5	79	4.91	3.91	0.00	18.00
AV_C6	79	12.80	9.20	0.00	46.50

Table Four: Projected Increases/Decreases in Student Engagement based Upon Actual Student Engagement Independent Variable Coefficients

	Total Category 1 changing from current study average up to 25%	Core Category 1 changing from current study average up to 25%	Total Category 2 changing from current study average up to 25%	Core Category 2 changing from current study average up to 25%	Total Categories 5 and 6 changing from current study average up to 60%	Core Categories 5 and 6 changing from current study average up to 60%
2 Level						
Comm Arts (ES)	-12.72 (-.58)	-10.39 (-.47)	-4.91 (-.26)	- 4.14 (-.22)	+6.36 (.16)	5.81 (.15)
Math (ES)	xxx	xxx	xxx	xxx	+5.56 (.14)	4.26 (.11)
Comm Arts (MS)	xxx	-10.63 (-.51)	xxx	xxx	xxx	7.93 (.18)
Math (MS)	xxx	-9.79 (-.47)	xxx	xxx	xxx	xxx
Comm Arts (HS)	-11.72 (-.61)	-13.68 (-.69)	-6.06 (-.39)	xxx	xxx	xxx
Math (HS)	xxx	-7.54 (-.38)	xxx	xxx	8.52 (.21)	8.88 (.21)
3 Level						
Comm Arts (ES)	-12.72 (-.58)	-11.34 (-.59)	-5.75 (-.37)	xxx	xxx	xxx
Math (ES)	xxx	xxx	xxx	xxx	5.96 (.15)	4.65 (.12)
Comm Arts (MS)	xxx	-9.17 (-.44)	xxx	xxx	xxx	9.04 (.22)
Math (MS)	xxx	xxx	-4.11 (-.28)	xxx	xxx	xxx
Comm Arts (HS)	13.68 (-.69)	-11.34 (-.59)	-5.75 (-.37)	xxx	xxx	xxx
Math (HS)	xxx	xxx	xxx	xxx	xxx	7.19 (.17)

xxx: Relationships not significant at the p<.05 level.

Table Five: Elementary School Variance Output

Elem School	COM ARTS T1	COM ARTS T2	COM ARTS C1	COM ARTS C2	COM ARTS C56	COM ARTS T56	Math T1	Math T2	Math C1	Math C2	Math T56	Math C56
Level I Model Reliability	.64	.60	.62	.60	.63	.63	.71	.70	.71	.70	.70	.71
Sigma	26.12	28.89	27.34	28.86	26.63	27.47	32.18	32.98	32.49	32.93	32.22	31.87
Tau	33.46	30.81	32.54	31.24	32.32	33.20	57.34	56.26	57.74	56.35	55.91	55.93
Across School	44	48	46	48	45	45	36	37	36	37	39	36
Across District	56	52	54	52	55	55	64	63	64	63	61	64

All reported variables were significant at the p<.05 level

Table Six: Middle School Variance Output

Middle School	COM ARTS T1	COM ARTS T2	COM ARTS C1	COM ARTS C2	COM ARTS C56	COM ARTS T56	Math T1	Math T2	Math C1	Math C2	Math T56	Math C56
Level 1 Model Reliability	.71	.66	.71	.67	.70	.69	.11	.03	.11	.03	.13	.13
Sigma	14.23	16.80	13.83	16.45	14.21	15.32	47.39	50.06	46.85	50.00	47.14	47.38
Tau	31.65	29.48	31.74	30.27	31.05	31.78	5.07	1.17	5.22	1.34	6.14	6.09
Across School	31	36	30	35	31	33	90	98	90	97	88	89
Across District	69	64	70	65	69	67	10	2	10	3	12	11

All reported variables were significant at the p<.05 level

Table Seven: High School Variance Output

High School	COM ARTS T1	COM ARTS T2	COM ARTS C1	COM ARTS C2	COM ARTS C56	COM ARTS T56	Math T1	Math T2	Math C1	Math C2	Math T56	Math C56
Level 1 Model Reliability	.16	.23	.16	.27	.23	.25	.09	.08	.09	.08	.07	.06
Sigma	48.62	46.82	46.87	47.07	50.33	49.37	79.31	80.36	78.64	81.81	79.90	79.66
Tau	8.30	12.49	7.66	15.22	13.50	14.38	6.42	6.33	6.88	6.07	4.85	4.41
Across School	85	79	86	76	79	77	93	93	92	93	94	95
Across District	15	21	14	24	21	23	7	7	8	7	6	5

All reported variables were significant at the p<.05 level

Appendices

Appendix Table A: Elementary, Middle, and High School (Three-Level) Output Beta Values Across the Three Levels of Study

	DV	IPI Categ.	Beta Levels by Variable									
			Tch Mast	FRL2	FRL1	Stu-Tch	Engag ement	PPE	Pct min	FRL3	Pct min	Mar-ried
ES	Math	C1	-.06	-.14	-.22 ***	-.05	-.25	-.03	-.11	.06	-.08	.02
ES	Com. Arts	C56	-.03	.00	-.16 **	.09	.14 ***	.04	-.07	-.03	-.10	.40 **
ES	Com. Arts	C1	-.05	-.05	-.17 **	.11	-.48 **	.05	-.06	-.13	-.08	.31 *
ES	Com. Arts	C2	-.02	-.01	-.18 **	.00	-.22 *	.04	-.07	-.02	-.09	.35 *
ES	Com. Arts	T1	-.05	-.05	-.17 **	.12	-.58 **	.05	-.04	.05	-.06	.32 *
ES	Com. Arts	T2	-.02	.00	-.19 **	.01	-.26 **	.04	-.07	-.02	-.09	.34 *
ES	Com. Arts	T56	-.02	-.01	-.15 **	.09	.15 **	.04	-.07	-.01	-.10	.39 **
ES	Math	C56	-.05	-.11	-.21 **	-.02	.12 **	-.03	-.12	.12	-.08	.08
ES	Math	C2	-.05	-.11	-.23 ***	-.10	-.17	-.03	-.12	.13	-.08	.04
ES	Math	T56	-.06	-.11	-.20 **	-.02	.15 *	-.04	-.12	.15	-.09	.08
ES	Math	T1	-.07	-.15	-.22 ***	-.03	-.34	-.03	-.10	.06	-.07	.02
ES	Math	T2	-.05	-.11	-.23 ***	-.09	-.19	-.04	-.12	.13	-.08	.04
MS	Com. Arts	T2	.14 **	.16	-.47 ***	-.09	-.12	.02	-.11 *	.45 *	-.29 **	.16
MS	Com. Arts	C1	.13 **	.15	-.45 ***	-.02	-.44 *	.00	-.08	.41	-.29 **	.17
MS	Com. Arts	C2	.14 **	.16	-.47 ***	-.11	-.10	.02	-.11 *	.47 *	-.29 **	.16
MS	Com. Arts	C56	.13 **	.09	-.38 ***	-.14	.22 **	-.02	-.08	.56 **	-.36 ***	.19
MS	Com. Arts	T56	.14 **	.12	-.42 ***	-.12	.12	-.01	-.09	.53 *	-.34 **	.21
MS	Math	C1	.17 **	.15	-.52 ***	.51	-.40	.11	-.21 ***	.28	-.06	.13
MS	Math	C2	.18 ***	.16	-.57 ***	.31	-.26 *	.13	-.23 ***	.34	-.09	.04
MS	Math	T1	.17 **	.15	-.53 ***	.47	-.34	.11	-.20 ***	.30	-.07	.14
MS	Math	T2	.18 ***	.17	-.51 ***	.34	-.28*	.14	-.23 ***	.32	-.09	.05
MS	Math	T56	.18 ***	.13	-.51 ***	.34	.16	.10	-.21 ***	.42	-.12	.18

MS	Math	C56	.17 **	.13	-.51 ***	.36	.11	.10	-.21 ***	.35	-.11	.16
MS	Com. Arts	T1	.12 **	.13	-.44 ***	-.03	-.38	-.01	.08	.43	-.30 *	.18
HS	Com. Arts	C1	-.26	-.17 **	.04	.53 **	-.69 ***	-.06	-.24 ***	-.16	.10	-.18
HS	Com. Arts	C2	-.21	-.16 *	-.02	.41 *	-.19	-.04	-.25 ***	.04	.09	-.05
HS	Com. Arts	C56	-.30	-.14	-.01	.48 **	-.02	-.03	-.28 ***	.02	.05	-.04
HS	Com. Arts	T1	-.26	-.16 *	.03	.52 **	-.59 ***	-.06	-.25 ***	-.03	.11	-.16
HS	Com. Arts	T2	-.16	-.16 *	-.03	.37 *	-.37 **	-.05	-.23 ***	.03	-.12	-.06
HS	Com. Arts.	T56	-.32	-.13	-.02	.51 **	-.09	-.03	-.29 ****	-.01	.03	-.04
HS	Math	C1	-.45	-.18 *	-.19 *	.34	-.31	.12	-.36 ****	-.03	-.11	-.10
HS	Math	C2	-.45	-.17	-.23 **	.28	-.03	.13 *	-.36 ****	.06	-.11	-.01
HS	Math	C56	-.41	-.20 *	-.17	.25	.17 *	.13 *	-.36 ***	.07	-.07	.00
HS	Math	T1	-.45	-.18 *	-.20 *	.34	-.29	.12	-.35 ***	.02	-.10	-.09
HS	Math	T2	-.40	-.16	-.23 **	.27	-.17	.13	-.37 ***	.03	-.10	-.04
HS	math	T56	-.39	-.19 *	-.18	.24	.19	.13 *	-.36 ***	.10	-.08	.00

<u>Explanatory Notes:</u>

ES: Elementary Schools; MS: Middle Schools; HS: High Schools

Com.Arts: Communication Arts State Assessment; Math: Mathematics State Assessment

IPI Category: Core and Total IPI Percentages for the Study Schools (See Figure 1)

Tch-Mast: Percent of Teachers with Masters Degrees

FRL1, FRL2, FRL3: Percent of students receiving free or reduced lunch (at levels 1,2,3 respectively)

Stu-Tch: Student Teacher Ratio

Engagement: the coefficient value of the IPI independent variable included in that particular model (ex: .59 = .59 units to corresponding IPI such as T56)

PPE: Per Pupil Expenditure

Pct_Min: Percent of Minority Students (specified at each level in the order it appears in Table)

Married: Percent of Students from homes with married parents

*: Significant at the .05 level; **: Significant at the .005 level; ***: Significant at the .001 level; ****: Significant at the .000 level

Appendix Table B: Elementary, Middle, and High School (Two-Level) Output Slope Values

School	**DV**	Beta Levels by Variable									
		IPI Categ	**Tch_ mast**	**FRL 1**	**Stu-tchr**	**Engag ement**	**PPE**	**Pct-min**	**FRL 2**	**Pct not**	**Married**
ES	Com. Arts	T1	-.06	-.17 **	.11	-.58 ***	.05	-.03	-.08	-.07	.33 *
ES	Com. Arts	C1	-.05	-.17 **	.10	-.47 **	.05	-.04	-.07	-.08	.31
ES	Com. Arts	C2	-.02	-.18 **	.00	-.22 *	.04	-.07	-.01	-.09	.35 *
ES	Com. Arts	C56	-.03	-.16 **	.09	.15 ***	.04	-.06	-.01	-.10	.40 **
ES	Com. Arts	T2	-.02	-.19 **	.01	-.26 *	.04	-.07	-.01	-.09	.35 *.
ES	Com. Arts	T56	-.04	-.15 *	.08	.16 **	.04	-.07	-.02	-.10	.40 **
ES	Math	T56	-.06	-.20 **	-.03	.14 *	-.05	-.13	-.09	-.09	.06
ES	Math	C1	-.07	-.22 **	-.06	-.25	-.04	-.11	-.14	-.07	.01
ES	math	C2	-.05	-.23 ***	-.10	-.17	-.04	-.13	-.10	-.08	.03
ES	Math	C56	-.05	-.21 **	-.03	.11 *	-.04	-.13	-.09	-.08	.07
ES	Math	T1	-.07	-.22 **	-.05	-.35	-.04	-.11	-.14	-.06	.02
ES	Math	T2	-.05	-.23 **	-.09	.18	-.04	-.13	-.09	-.08	.03
MS	Com. Arts	C1	.12 *	-.44 ***	.14	-.51 **	.01	-.11 *	.20 **	-.33 **	.19
MS	Com. Arts	C2	.13 *	-.46 ***	.07	-.09	.03	-.15 **	.21 **	-.33 **	.20
MS	Com. Arts	C56	.12 *	-.38 ***	.07	.18 **	.01	-.13 **	.15 *	-.39 **	.23 **
MS	Com. Arts	T1	.12 *	-.43 ***	.13	-.43 **	.00	-.11 *	.19 **	-.34 **	.20
MS	Com. Arts	T2	.13 *	-.46 ***	.08	-.13	.04	-.15 **	.21 **	-.33 **	.19
MS	Com. Arts	T56	.13 *	-.41 ***	.08	.08	.02	-.14 **	.19 *	-.36 **	.25 **
MS	Math	C1	.16 **	-.50 ***	.63 *	-.47 *	.12	-.23 ***	.16	-.09	.14
MS	Math	C2	.17 **	-.53 ***	.50	.26	.15 *	-.26 ***	.17	-.10	.08

MS	Math	C56	.16	-.48 ***	.52	.09	.12	-.25 ***	.16	-.12	.18
MS	Math	T1	.16 **	-.50 ***	.62	-.40	.11	-.23 ***	.17	-.10	.15
MS	Math	T2	.17 **	-.53 ***	.52	-.28	.16 *	-.27 ***	.18	-.10	.08
MS	Math	T56	.17 **	-.48 ***	.52	.11	.11	-.25 ***	.17	-.13	.20
HS	Com. Arts	T2	.03	-.02	.32	-.39 **	-.04	-.24 ***	-.16 ***	.12	-.06
HS	Com. Arts	C1	.03	.04	.48 **	-.69 ***	-.07	-.18 ***	-.22 ***	.10	-.16
HS	Com. Arts	C2	.03	-.01	.32	-.23	-.05	-.24 ***	- .17** *	.10	-.06
HS	Com. Arts	C56	.04	-.01	32	.00	-.05	-.23 ***	-.17 ***	.10	.01
HS	Com. Arts	T1	-.02	.02	.44 **	-.61 **	-.08	-.18 ***	-.19 ***	.13	-.14
HS	Com. Arts	T56	.04	-.02	.32	-.05	-.04	-.23 ***	-.17 **	.09	.01
HS	Math	T2	-.05	-.23 **	.22	-.23	.11	-.36 ***	-.17 *	-.11	-.10
HS	Math	C1	-.09	-.20 *	.31	-.38 *	.10	-.33 ***	-.21 *	-.13	-.17
HS	math	C2	-.05	-.23 **	.21	-.10	.11	-.35 ***	-.17 *	-.12	-.08
HS	Math	C56	-.08	-.17	.20	.21 **	.10	-.35 ***	-.21 **	-.08	-.07
HS	Math	T1	-.09	-.20 *	.30	-.37	.09	-.33 ***	-.19 *	-.11	-.17
HS	Math	T56	-.06	-.18	.18	.21 **	.10	-.34 ***	-.19 *	-.08	-.06

<u>Explanatory Notes:</u>

ES: Elementary Schools; MS: Middle Schools; HS: High Schools

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IPI Category: Core and Total IPI Percentages for the Study Schools (See Figure 1)

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Stu-Tch: Student Teacher Ratio
Engagement: the coefficient value of the IPI independent variable included in that particular model (ex: .59 = .59 units to corresponding IPI such as T56)
PPE: Per Pupil Expenditure
Pct_Min: Percent of Minority Students
Married: Percent of Students from homes with married parents
*: Significant at the .05 level; **: Significant at the .005 level; ***: Significant at the .001 level

Appendix Table C: Empty (No Independent Variable) Model Variance Output

ELEMENTARY SCHOOL	Com Arts	Math
L1	.75*	.80*
Sig	30.63	36.08
Tau	68.24	109.03
School	31	25
District	69	75
MIDDLE SCHOOL	Com Arts	Math
L1	.77*	.65*
Sig	26.01	55.35
Tau	82.70	95.68
School	24	37
District	76	63
HIGH SCHOOL	Com Arts	Math
L1	.56*	.64*
Sig	44.18	58.67
Tau	50.97	97.21
School	46	38
District	54	62

*All findings in Appendix Table C are statistically significant at the p<.05 level.

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