Student Engagement in a High-Stakes Test Environment: 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 all nine professional development regions of Missouri were considered. We postulated that both higher-order engagement, non higher-order engagement, and teacher and student disengagement would impact student achievement levels. Additionally, we expected to find that the extent of the relationship may not be the same for higher-order, non higher-order, and disengagement. Findings affirmed 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, the extent of the influence varied widely, with higher-order student engagement enhancements yielding 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 engagement and disengagement relationships to achievement, 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 produce comparable gains and declines on standardized achievement tests for each school building type.

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 an important diagnostic function within all classrooms by allowing faculties to quantify 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. 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 cannot afford to dedicate either the time or the effort to loose experimentation with curricular practices in their attempts to 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 likely exists 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), as an example, convincingly stresses 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 (most notably teachers), must not be discounted. 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). But, 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 upon 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).

While school leaders are responsible for undertaking the school improvement initiatives required to provide the most suitable academic environment for students, it is the teachers who are ultimately tasked with executing these educational initiatives within their classrooms. Studying teachers' abilities to influence or otherwise impact student learning can be exceedingly useful, and is not dissimilar to the literature that seeks to determine a school's contribution to student achievement (Druian & Butler, 1987, citing Meyer 1996). Teacher quality has been demonstrated to substantially influence student learning (Druian & Butler, 1987). While such a finding is not surprising, amassing evidence as to what constitutes good teaching is far from a trivial undertaking.

It is important to determine those traits that define and characterize quality teaching and to ensure that such practices occur in all classrooms, as student learning is strongly impacted by the quality of such teacher instruction (Druian & Butler, 1987). Much like differentiating a school's contribution to student learning from other contributing sources of student achievement can be exceedingly useful in determining effective school practices, so too can narrowing the research focus to teacher effects on student learning (Druian & Butler, 1987). Clearly, students become more actively engaged in the learning process when teachers stress relevance in their curriculum (Brophy, 1990).

The differential rate at which organizational learning occurs between schools has repercussions far more reaching than the growth of administrator knowledge or growth in the effectively employed practices by school leaders. Ultimately, stunted or non-existent organizational learning in schools yields an environment in which students do not have access to adequate and appropriate teacher instruction. Such educational inequity is perhaps partly attributable to the fact that many schools are not utilizing their accomplished teachers effectively. A study conducted by Davis and Tinsley found that half of the teachers observed asked no application, analysis or synthesis questions (Lewis, 1978). As not all teachers possess the same level of competence, those students situated within effective or ineffective classrooms, a determination entirely outside of their control (Waxman, Huang, Abderson, & Weinstein, 1997), can materially affect the level of such students' learning. Moreover, students' prospects for success in their future academic and professional undertakings also hinges largely on instructional quality.

A problematic, yet prevalent, practice among public schools involves placing low-track students in classrooms with teacher instruction that is of markedly lower quality than their high-track peers (Applebee et al., 2003). Placing certain students on a pre-determined lower-track of coursework can severely diminish these students' chances of receiving an adequate education. The pernicious effects of historical tracking practices can be ameliorated, however, as introducing low-track students to higher-order student engagement will allow for markedly greater gains relative to their high-track counterparts, which can narrow the achievement gap (Vanosdall, Klentschy, & Weisbaum Hedges & Weisbaum, 2007). Such a finding compels the researcher to test the relationship between higher-order student engagement levels and the practices and processes that are evidenced over the lifespan of the IPI treatment and consider the extent to which socioeconomic variables may be less impactful on student engagement levels within schools than on standardized test performance levels. More specifically, as struggling students within schools, or schools that are themselves at a disadvantage in terms of resource endowments, have evidenced profound gains which were enjoyed by schools that were once written-off as being unable to benefit from such practices and processes, this suggests that the extent to which socioeconomic considerations might not be an appropriate metric for considering student engagement behaviors within classrooms.

The extent to which heightened intellectual inquiry and exploration might then be translated into achievement gains for all students in public educational settings begs for empirical testing. Focusing on the practices and processes adopted by schools that can be statistically demonstrated to galvanize higher-order student engagement levels is a complex process.   Various socioeconomic variables associated with student achievement are incorporated into the more encapsulating models to better test student engagement-achievement relationships.

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 both an effective and expeditious way of preparing students for high-stakes testing, it may fail to enhance students' critical thinking and reasoning abilities.

It is commonly thought that the objectives of adequate test preparation and teaching students critical thinking and learning skills are mutually exclusive endeavors. While pre-packaged curricula tightly aligned with accountability standards leave less slack for incorporating additional opportunities for academic exploration, teaching students critical thinking skills can compliment traditional test preparation practices (Weast, 1996). The more deleterious practice of dedicating instructional efforts to teaching appropriate thinking skills only to those students who are likely to pass such tests has become more commonplace in the accountability era (Ding & Davison, 2005). It should come as no surprise that the achievement gap, in part spawned by such instructional practices, is so wide that the pronounced initial student performance and ability differences are not bridged over time (Ding & Davison, 2005).

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 critical to academic success that teachers and school leaders realize 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, 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/deeper 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. Indeed, be it on standardized tests or in their professional lives, these students 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).

The role of the teacher in facilitating higher-order classroom instruction is a vitally central and irreplaceable component of galvanizing higher-order student learning (Underbakke, Borg, & Peterson, 1993). As a teacher employs higher-order cognitive questioning, a practice that can largely complement traditional curriculum, this instructional technique better enables the student to manipulate and synthesize previously learned information in such a fashion that will allow students to form postulations in a logical and well-reasoned fashion (Cotton, 1989).

A pervasive assumption exists among educators that students must master basic skills before moving on to higher-order skills (Freeman, 1989). Unfortunately, such a belief has spawned educational environments in which it is not uncommon to find students unchallenged in classrooms. Student under-stimulation in the classroom can not only lead to heightened levels of student apathy within schools, but can create inequity across schools and school districts (Freeman, 1989). In actuality, traditional curricula that are designed to prepare students for standardized tests also provide abundant opportunities for teachers to engage students in higher-order activities. Indeed, actively engaging students in higher-order thinking enables students to more effectively process information (Underbakke, Borg, & Peterson, 1993).

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. It is commonly the case that increased perceptions of their limitations are unearthed by 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).

Standardized test scores are often assailed as a fallacious metric for gauging true student achievement. Nevertheless, schools are oftentimes deemed to be effective based upon their students' standardized test performance (Caldas & Bankston, 1999). Judging school effectiveness solely on this test score performance criteria is problematic. For example, increased scores might be achieved by manipulating test standards and the testing instruments without truly effecting the actual level of student achievement (Nozawa, Waltman, & Lai, 2007). Nozawa et al. (2007) document the practice of coaching students before and during tests as a potential source of bias in individual scores. Consequently, high performance on a particular testing instrument does not necessarily represent learning (Nozawa et al., 2007).

While test scores represent more than meaningless data on school effectiveness and student performance, such scores should be one of several performance indicators used to judge school quality (Rumberger & Palardy, 2005). Were a school's transfer and dropout rates given active consideration, for instance, these alternative indicators of school performance would allow for a more complete assessment of school effectiveness. Rumberger and Palardy (2005) suggest that test scores, student attendance, and dropout rates might be influenced by a number of common factors. The authors also 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. Such a method allows for an informed instructional design that codifies and charts the process of learning in the classrooms of the school. Initially developed by Painter and Valentine in 1996 and refined by Valentine in 2002, the IPI process 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 educators 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 is 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 that allows the researcher 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 offers a more complete layout of each of the six coding categories. 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 important to note, however, that 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. Many times, this may mean coding student engagement that is generally more cognitively, physically, and emotionally passive.

Insert Figure 1: IPI Category Descriptions approximately here

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Descriptive Data

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 independent variable serve as a telling metric by which to quantify the disparate impact that student engagement exacts upon standardized achievement levels.

Insert Table One Approximately Here

Insert Table Two Approximately Here

Insert Table Three Approximately Here

STATISTICAL FINDINGS

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 are presented in Appendices A and B. 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. Student, teacher, and school 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 Approximately Here

Interestingly, the vast majority of models tested contained student engagement independent variables whose coefficient magnitudes were found to be statistically significant ($p<.05$). In the three-level model, for instance, student disengagement in core classrooms (C1) in 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) with 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.

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 a 45% of variation in communication arts test performance is attributable to between school differences while the remaining 55% is attributable to 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 Approximately Here

At the middle school level, communication arts achievement variance was generally apportioned at a 35-65% level for the across-school and district levels. 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 was accounted for at the district level. 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 Approximately Here

Insert Table Seven Approximately Here

Ultimately, no readily identifiable pattern emerges across school type or between content areas 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. In light of these findings, no conclusive explanation of the variance dispersion can be offered.

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, teachers and administrators 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, teachers are then empowered to chart a more data-driven course for student engagement.   The findings from this study indicate that the teacher-driven benchmarks will serve to augment standardized test passage rates.

School administrators are urged to approach the use of the IPI with an understanding of the importance of teacher empowerment. An administrator's arbitrary pursuit to reduce the non higher-order and disengaged learning and garner 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 staff determined 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. 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 pass rate declines on high stakes tests 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 an enormous effort. For each raw percentage increase in 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 teachers and school leaders to continuously study and address their school-wide levels of disengagement.

TEMPORAL CHANGE

The IPI provides a temporal design for change. It is important to stress, however, that 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 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 higher-order student engagement average levels hover around 20% of all student classroom learning time as measured by the IPI process. Enhancing the current 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. Viewing the 40% gap in 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, and collaborative conversations supporting pedagogical strategies would become more pronounced. This transformative effect would then provide the requisite propulsion needed to thrust the school's higher-order thinking levels on a steady incline. Encouragingly, the potential value of focusing more expertly and empirically on engagement in a school can be both substantial and sustained.

PROJECTED ENGAGEMENT LEVELS AND STUDENT ACHIEVEMENT

Projected relationships between levels of engagement and student achievement on high-stakes tests were 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 or three-level analyses. 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 engagement/teacher non-engagement (Category 2) with a 25% "spike scenario" that could readily occur in many of our nation's public schools. Such a benchmark represents levels of disengagement that are dangerously elevated. Conversely, computations were also made for higher-order/deeper thinking reflecting a more optimal goal of 60%, a level clearly associated with higher rates of student achievement. This is an upper 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 a powerful, 9.17 percentage point impact. The findings were also the same in the three-level model for the elementary and high school levels 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 an upper bounds of 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 respectively) from the significant findings in the two-level model. A noteworthy gain of 6.36 percentage points was also evident in the elementary two-level model for total (all observations) 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 mathematics findings do provide meaningful insights, though. 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) results in 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 with 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 projected at the more robust level of 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). 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. For Mathematics, anticipated achievement gains of 5.96 and 4.65 at the elementary level are associated with higher-order engagement (T56 and C56 respectively) in the three-level models.

GRADE LEVEL DIFFERENCES NECESSITATE UNIQUE APPROACHES

Undeniably, public education systems now find themselves entrenched in a policy environment of standardization. Mandates and directives meted out by the federal government commonly assume a one-size-fits-all focus. Findings from this study strongly 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 that all of 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 if/when student disengagement within schools increase from current levels to 25%. Communication Arts achievement would decline by 10.63 points in middle schools 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 by 7.54 passage rate points in high schools and 9.79 passage rate points in middle schools when disengagement in core classes reached the 25% level.

Our findings also reveal apparent dissimilarities in the extent to which higher-order student engagement affected standardized achievement across content areas. More specifically, were higher-order student engagement levels in all classrooms ("T56") to increase from their current levels to the more ideal 60% benchmark, mathematics gains of 5.56 points in elementary schools and 8.52 points high schools would accrue. Communication Arts findings, on the other hand, were not statistically significant across school types. We speculate that this difference can be associated with the more defined forms of assessment items used in mathematical problem solving on standardized assessments compared to the less defined, more open and abstract forms of questioning found in the communication arts assessments. Even the scoring protocols in communication arts can be more “subjective” than are the right-wrong answers for mathematical assessments. As such, the empirical link is more evident when statistically analyzed under this framework.

Our study offers empirical evidence that public schools warrant tailored and site-specific improvement initiatives. The statistical influences of engagement on achievement across school types remained consistently strongest for high schools and slightly less strong for middle and elementary grade levels. While high school standardized achievement performance levels appear to be more impacted by student engagement levels, all three school levels evidence significant standardized achievement fluctuations based upon the corresponding student engagement levels. Simply put, significant statistical relationships were found at all grade levels, albeit at different levels of influence across those grade levels.

The Role of the IPI in a High Stakes Testing Environment

To best appreciate the IPI’s designed function in the pronounced accountability era, it is useful to first elucidate precisely what the IPI is not. The IPI is not designed to rapidly catapult school proficiency levels to meet the designated AYP benchmarks. Nor is the IPI meant to provide teachers with a pre-defined curricular script for how to best convey content-area subject matter to their pupils.

Embedded within the IPI process is a structure which dignifies the principle that all schools are not created equal. Faculties are, quite frankly, at different competency levels when the IPI is introduced within their schools. Moreover, faculties learn at widely differentiated rates. With this in mind, the IPI enables school leaders and faculties to first gauge where it is they currently stand with engagement when they initiated the IPI process within their schools. Far from concentrating these assessments and subsequent initiatives under administrative prerogative, the IPI encourages input and leadership from the faculty leaders. As a result, school leaders tend to find more direction, professional development, and steady faculty learning. Open and continuous faculty dialogue, goal-setting, and retrospective analyses of their practices over time provide a powerful impetus to advance our schools not merely as public organizations, but as learning organizations.

The Power of Disengagement

Without exception, student disengagement is found to negatively impact standardized achievement. Empirically, the relationship between disengagement and standardized achievement is remarkable. Indeed, the predictor values yielded by the HLM models confirm that, for all school types. every percentage point of student disengagement matters.

Throughout our data findings we have noticed a "*two-to-one rule of thumb*." That is, every two percentage point increase in disengagement will accompany a percentage point decline in standardized test achievement. The powerful impact of student disengagement across school levels is reason for caution. Student disengagement is consistently and materially shown to drive down standardized test scores.

Also noteworthy is the relative impact of student disengagement on learning as opposed to the more desirable forms of higher-order and critical thinking. We have found a second theme among the data and refer to it as the "*four times the influence*" rule. More specifically, student disengagement data from our data analyses exhibits approximately four times the impact on standardized achievement than is the case for higher-order thinking.

It then becomes important to harmonize these principles with current instructional practices and processes. First, student disengagement levels are far too impactful to ignore. While current student disengagement levels in public schools are likely to be quite low, teacher diligence in ensuring these levels remain tempered should be a paramount concern. In fact, no rationale exists to justify *any* student disengagement observations. As such, school leaders are advised to use such findings as a substantive justification to extinguish classroom disengagement altogether.

Finally, school leaders must not become lulled into exclusively monitoring lower order thinking. True, low to nonexistent levels of student disengagement suggest that more desirable forms of pedagogy are at play in the classroom. Nevertheless, the school buildings larger instructional composite can become preponderantly comprised of didactic or non higher-order types of instruction. Such pedagogical types are also undesirable for both those school leaders undertaking reform efforts as well as for those who seek to retain effective learning environments.

Higher-order Thinking Take-aways

There is little doubt that elementary and high school instructional environments should look quite different. Teachers at both levels are tasked with considerably dissimilar accountability demands. Moreover, administrative and parental expectations can be quite different for each building type. On a more intuitive basis, the higher-order thinking and test score growth would be expected to be most greatly impacted at the high school level.

To be clear, a place exists for higher-order thinking in elementary schools. Yet, the extent to which higher-order thinking in students' early schooling would be as translatable into test score growth as high schools ignore, at least conceptually, the very different composition of the standardized testing instruments at these grade levels. Establishing a sound foundation upon which students can critically process and synthesize information should, and indeed must, begin in the student's elementary school years. But as these elementary school students sit for standardized tests, they will be required to process the test content in more rudimentary and rote ways. Not surprisingly, elementary higher-order thinking is not as notably influential upon standardized achievement levels is an intuitive finding.

High school standardized testing, on the other hand, presents different sorts of demands on students. In Missouri, as in many states across the nation, it is common to find open-ended test questions that seek to probe the thoughtfulness, critical thinking, and information synthesis. Pedagogy that fosters student higher-order and critical thinking does more than capture the attention of students of the classroom hours.

Consistent and intense instructional practices that are replete with techniques that encourage deeper thinking and interrogation of complex concepts provide students with skills not attained by classrooms where didactic information conveyance is the order of the day. Not surprisingly, then, more exacting high school testing conditions are met with greater success by those students who are accustomed to thinking and applying information critically on a daily basis.

While clearly important in high schools, school district leaders are advised that the investment in higher-order engagement is time well spent across all buildings. High school instructional pedagogy that stimulates the kinds of higher-order thinking that ensure students will possess critical thinking capacities is a hallmark of pedagogical excellence.

The skills needed to expand upon the more basic and foundational competencies must begin in elementary schools. As students are introduced to higher-order and critical thinking concepts at an early age, the firming of these capacities over time will be impressive. Undeniably, building a capacity for future learning throughout the course of the student's tenure in public schools starts at the elementary school level. While elementary school student engagement is not shown to greatly impact standardized achievement, it is nonetheless as vitally important for broader instructional and curricular success as is the case at the high school level.

Defining the Empirical Forrest After Studying the Trees

Two-level HLM model output, provided in Table 8, include the test score gains that result from higher-order student engagement levels growth from 20 to 60%. It is shown that test score gains grow in magnitude according to grade level progression. That is, test score gains are less in elementary than middle school, and both these school types exhibit less test score growth than at the high school level.

Insert Table Eight Approximately Here

Further remarks are warranted for the discrepancy found to exist at the elementary and high school levels. Interestingly, test score growth at the high school level is fully two times as great as elementary score performance levels when higher-order engagement levels in schools augment to 60% of all recorded classroom observations. The difference between elementary and middle school communication arts levels were also dissimilar, but less so than was the dispersion between elementary and middle school test scores with the impact on high school performance (with identical student engagement fluctuations).

Less coherent trends across school types can complicate the discussion somewhat. The three-level HLM output findings, provided for the reader in Table 9, illustrate the principle more fully. Most straightforward in the disengagement findings are the uniformly elevated standardized performance declines that accompany student disengagement spikes. This time, however, elementary school performance declines trumps the depression of middle school scores. Still, high school standardized performance levels remain more impacted by disengagement than at any other level.

Insert Table Nine Approximately Here

While high school performance was, for the most part, most greatly impacted by student engagement levels, this was not unequivocally so. For instance, communication arts performance across middle school was more appreciably affected by higher-order thinking at the middle school level than for high school level. Indeed, middle school test score growth was over twice as great for this segment of the data than was the case for elementary schools.

Concluding Thoughts

Two takeaway points are to be had from the data findings that serve as a summary of the significance of this study. First, while the disparity was not particularly glaring between elementary and middle schools, it is important to stress that it was not always the case that high school test score growth was most impacted by the student engagement numbers. Second, these charts are far from unrealistic. That is, the resulting test score gains produced from the charts has achievement implications for growth levels less than a more optimal growth target. Schools in Missouri *currently evidence* a 40% disparity in higher-order thinking levels. The model predictions demonstrate noteworthy test score discrepancies based upon these student engagement levels. The student disengagement findings can be interpreted as a predictive tool to closely prognosticate test score depression in the wake of ballooning disengagement levels. Similarly, a quantitative modeling of test score differences that account for the 20%

disengagement growth serves as an empirical basis of monitoring student engagement levels across public schools.

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

Table 8: Impact of Projected Increases of High-stakes Pass Rates from Current Levels to Stated Levels from Two-Level HLM Analyses

Two-Level HLM Analyses	Total Higher-Order Engagement up to 60%	Core Higher-Order Engagement up to 60%
Comm. Arts (ES)	6.36 (.16)	5.81 (.15)
Math (ES)	5.56 (.14)	4.26 (.11)
Comm. Arts (MS)	NS	7.93 (.18)
Math (MS)	NS	NS
Comm. Arts (HS)	NS	NS
Math (HS)	8.52 (.21)	8.88 (.21)

Table 9: Impact of Projected Increases/Decreases of High-stakes Pass Rates from Current Levels to Stated Levels from Three-Level HLM Analyses

Three Level HLM Analyses	Total Student Disengagement Up to 25%	Core Student Disengagement Up to 25%	Total Higher-Order Engagement up to 60%	Core Higher-Order Engagement up to 60%
COmm. Arts (ES)	-12.72 (-.58)	-11.34 (-.59)	NS	NS
Math (ES)	NS	NS	5.96 (.15)	4.65 (.12)
Comm. Arts (MS)	NS	-9.17 (-.44)	NS	9.04 (.22)
Math (MS)	NS	NS	NS	NS
Comm. Arts (HS)	-13.68 (-.69)	-11.34 (-.59)	NS	NS
Math (HS)	NS	NS	NS	7.19 (.17)

Appendices

Appendix 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	Engagement	PPE	Pct min	FRL3	Pct min	Married
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

Explanatory Notes:

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 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**	**% Not Trans ient**	**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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