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### *Abstract*

*The relationship between the nature and levels of student engagement with statewide standardized test performance levels is of great interest to a great many high school educators. This paper was designed to provide empirical answers to this and other important practitioner-tailored questions. All told, student engagement data from 79 public high schools in all nine regions of the state were considered. While the nature of student engagement is theorized to impact student achievement levels, the extent of this relationship may not be the same for higher and lower engagement. As postulated, higher-order student engagement enhancements lead to noteworthy increases in standardized achievement, while lower-order thinking levels detrimentally impact student learning at more pronounced rates. Indeed, school faculty and administrators should pay particular attention to the finding that student disengagement is twice as influential as higher-order classroom engagement on standardized achievement levels.*

High school educators face a unique set of challenges as they attempt to promote heightened learning and achievement within their classrooms. There is nothing terribly complicated about the twin goals of buttressing higher order thinking and standardized achievement levels. Ultimately, though, instructional leaders' on the ground attempts at effectuating educational excellence entail a much more complicated enterprise. Accordingly, a more complicated inquiry and discussion about advancing the aims of instructional improvement

across high schools is necessary. It is important that empirical studies make such an undertaking more manageable. Accordingly, two central aims of this paper are to (1) present from a research standpoint, and (2) to implement on the practitioner side of the findings, a straightforward and complete explanation of the relationship between instructional quality and resulting standardized achievement levels in the nation's public high schools.

This paper first begins by taking into account the broader approach to delineating and quantifying the nature of student engagement at the building level. From this approach, a better appreciation of the desirable forms of higher order and critical thinking can then be had. Explored next is how these desirable learning behaviors translate into heightened achievement levels. The converse, however, is no less important. That is, environments where lower order thinking and detached classroom learners are most prevalent must also be considered. Interpreting both sides of the pedagogical equation in such depth has its benefits. Indeed, not only the direct impact, but also any differential effect, that student engagement exhibits on standardized achievement, becomes more readily identifiable. Such a method allows for a more digestible discussion of the relationship between student engagement and achievement that moves away from a bare bones discussion of the hard numbers alone.

## **Review of Literature**

### *1a: Ideal High School Instructional Quality*

Research on teacher quality and effectiveness can be valuable in informing high school faculty and administrators of those desirable and undesirable instructional characteristics.

Heistad (1999) conducted a study of exceptional teachers and found that such educators endorsed more teacher-directed activities, more development of word attack strategies and more use of

individual student oral reading (Heistad, 1999). Heistad (1999) notes that exceptional teachers commonly 1) model reading to students on a daily basis, 2) engage in the practice and repetition of isolated skills, 3) engage in a combination of group work and individual work, 4) assign pairing of work, 5) integrate reading into the curriculum, and 6) continuously monitor and promote student self-regulation. Additionally, Druian and Butler (1987) found that outstanding teachers possess good time management skills, assign student work at the appropriate difficulty levels, and use positive reinforcement with students. The importance of communication and relationship building among school personnel in promoting more excellent forms of education is also well-documented in the current literature (Dozier, 2007).

The importance of the teacher's role in the educational process is central in providing a quality education to students (Lewis, 1978). Teacher quality has been demonstrated to exhibit substantial effects on student learning, as well (Druian & Butler, 1987). Teachers that employ the Socratic method of conversation-stimulating questions to challenge students to elaborate on their assumptions and interrogate their own thought processes were found to be highly effective (Cotton et al., 1989). Placing these findings in the perspective of the high school classroom is important. Though these learners are situated at the end of their K-12 journey, their broader knowledge bases are accompanied by taller expectations: they must digest and synthesize more complex and voluminous amounts of content. As the next section of the paper documents, an appropriate curriculum is need to orient teachers' instructional practices in ways that can universally translate into more blossoming forms of student learning and outcomes.

*1b: Ideal Curricula, Excellent Instruction*

High school curricula that are designed to foster critical thinking skills and instruction will ultimately serve to benefit students. As teachers introduce and develop critical thinking among their students, this involves not only the growth in student learning while in school, but the applications of such thinking skills, as these students will eventually enter into society (Geertsen, 2003). It has been demonstrated that students benefit greatly from engaging in reflective thinking and critical judgment (Geertsen, 2003). Such reflective thinking requires students to give active consideration to new ideas, and to scrutinize new and existing knowledge, which enhances students' tendencies to be inquisitive (Geertsen, 2003). Students must possess these higher-level thinking skills that surpass casual, rudimentary everyday thought if they are to engage in continuous learning (Geertsen, 2003).

The goal of formal education, and the curricula that guide it, is to create independent thinkers (Lewis, 1978). For school leaders to strike an appropriate balance between adopting innovative and challenging curricular initiatives while also focusing on traditional test preparation goals involves a certain degree of difficulty. Educational research is replete with evidence that demonstrates that teachers who provide students with basic factual content and encourage them to frequently recite such knowledge translates into more effective standardized test performance (Cotton et al., 1989). Not surprisingly, basic end-of-the-year objectives oftentimes lead to lackluster educational provision. Hence, a simple test score proficiency metric is not without controversy, as it encourages not only these tracking practices, but it also promotes a myopic focus on test preparation among students that is too narrowly conceived. The reader should also note that instruction that includes actively engaged student learning need not be reserved for only middle and high school grade levels. In high schools, no less than any other

instructional environment, implementing a curriculum that appropriately challenges students, but also guides the instructional ways of high school educators, is imperative. High school faculties that press their students to more actively and continuously engage the content material open the door to more desirable forms of student engagement that can take hold over time. A consideration of the literature that suggests what and how this is to be done across high schools becomes the focus of the next section of the paper.

### *1c: Toward a Structured Testing of Classroom Quality*

Today's K-12 educational environments are home to a different generation of students who present different instructional challenges for educators. Considering the ways in which high school students are engaged, and the resulting impact on standardized achievement levels, is a relationship of interest to a great many high school educators across the nation. Though high school represents the final phase of K-12 education, classroom quality continues to matter a great deal in dictating how much these students learn.

This paper begins by revisiting what is known about instructional quality. The impact of teacher pedagogy, as well as the curricula that they design, are shown by the literature to make a difference in tuning students into classroom instruction and onto daily learning. Focusing on the proven methods in best educational practices is an important step in understanding why resulting high school engagement behaviors look the way they do. The impact of student engagement on standardized achievement is, therefore, placed into coherent context.

### *2a : Critical and Higher-Order Thinking*

Before considering how to best stimulate critical thinking in classrooms, it is important to determine what constitutes both student thinking and critical thinking. Geertsen (2003) defines

thinking as “a mental process in which something is turned over in the mind to make sense out of experience” (Geertsen, 2003, p. 1). Critical-thinking skills are not innate to students. In fact, the development of students’ critical thinking skills takes several years, as it involves the development of cognitive dissonance, reflection, and repetition (Webster, 1990). Differential levels of student critical thinking also vary based upon the student’s grade level. During students’ secondary years, they typically learn to generate experimental procedures, reflect upon the adequacies and inadequacies of these procedures, and engage in hypothetical learning exercises (Webster, 1990).

Student learning entails not just information acquisition, but curiosity, critical thinking, and students’ social sense (Daniel et al., 1999). The application of higher-order thinking skills involves students “elaborating the given material, making inferences beyond what is explicitly presented, building adequate representations, analyzing and constructing relationships” (Resnick, 1987, p. 133). Such higher-order thinking challenges the student to interpret, analyze, manipulate, or otherwise synthesize information (Lewis & Smith, 1993). Brophy (1990) suggests that higher-order thinking requires that students possess: 1) an in-depth knowledge of content, 2) skills in processing information, and 3) the attitudes or dispositions of reflectiveness (Brophy, 1990). Effective teachers with high achieving students were found to be more likely to engage their students in the critical thinking and problem solving activities that require higher-order thinking, although these teachers acknowledged that their students were oftentimes initially resistant to such activities involving higher-order thinking (Brophy, 1990).

While it is not always feasible for high school educators to provide fully differentiated instruction to students, it is nevertheless the case that students will demonstrate distinctive and idiosyncratic learning needs in these settings. All children benefit, however, from access to a classroom environment that is conducive to enabling students to engage in critical analysis and intellectual exploration (Cotton, 1989; Pogonowski, 1987; Webster, 1990). Furthermore, the personal experiences of students matter in how those students continue to learn. Underbakke, Borg and Peterson (1993) note that “the most powerful predictor of how much students learn is what they know prior to entering the classroom” (p.138). As students enter the high school phase of their educational careers, they are expected to be more knowledgeable and critically analytical. High school educators who actively challenge these children to further hone their critical and higher order thinking capacities will best position these students to post the outcomes performance growth that manifests these skill sets and academic competencies.

Teachers should provide additional assistance to those children who experience trouble developing their higher-order skills (Lewis, 1978). Higher-order thinking skills and activities must be appropriate to the current developmental stage of students. Cotton et al (1989) note that for older students, higher cognitive questions are related to increases in: 1) the levels of on-task behavior, 2) the length of the student response, 3) the number of relevant contributions, 4) the number of student-to-student interactions, 5) the student use of complete sentences, 6) the extent of speculative thinking, and 7) the amount of relevant questions posed by students. As teachers involve their students in higher-order thinking activities, this provides students with an adequate opportunity to engage in abstract thinking (Pogonowski, 1987). In the high school setting, it is imperative that students possess higher order capacities that empower them to perform more

competently on standardized tests, but also in their imminent higher educational and vocational pursuits.

To gain a better appreciation of the nature of higher-order thinking, it is useful to contrast it with the lower-order learning that is commonplace within classrooms. Cotton et al. (1989) write that “lower cognitive questions are those which ask the student merely to recall verbatim or in his or her own words material previously read or taught by the teacher” (Cotton et al., 1989). Lower-order thinking does not require student judgment or interpretation, as this lower-order problem solving is largely intuitive and obvious. As such, lower-order thinking requires only basic cognitive skills such as description, explanation, and illustration with examples (Daniel, Lafortune, Pallascio, & Schleifer, 1999; Lewis & Smith, 1993). Conversely, higher-order cognitive questions ask students to mentally manipulate bits of information previously learned and create answers or support answers with logical evidence (Cotton et al., 1989). Furthermore, higher-order thinking can be characterized by several defining features, which may be evidenced in the form of students’ responding to lectures in a complex way, justifying these responses, expressing a nuance, familiarizing a question, developing logical relationships, hypothesizing, and criticizing (Daniel et al., 1999; Lewis 1978; 1993). Ultimately, teachers are capable of dictating the nature of their pedagogical practices and other classroom activities that actively facilitate such higher-order thinking. High school students’ daily interests, activities, and ambitions follow them to their seats each morning. High school instructional leaders must continuously strive to tap into these complexities rather than brushing them aside in the name of accountability progress.

## *2b: Proven Instructional Strategies*

Teachers who seek to impart effective analytic strategies and skills to their students can do so by employing explicit pedagogical techniques (Marzano, 1993). More explicit instruction on teaching thinking includes engaging students in the practice of identifying component parts and articulating the relationships among the parts (Marzano, 1993). This can be accomplished in a more knowledge-free fashion, in which a student's learning capability is not dependent upon his or her current content knowledge base (Nickerson, 1988; Webster, 1990). It is important that teachers avoid didactically conveying factual information to students (Heistad, 1999). Be it on standardized tests or in their professional lives, students will be challenged to think critically and creatively, and they should be educated accordingly.

Also of vital importance is the students' ability to adroitly problem-solve in both high school classroom and employment contexts. Consequently, teacher instruction that incorporates problem-solving skills will be of great value to students. Student problem solving often involves a process of students': a) becoming aware of the problem, b) gathering data, c) forming hypotheses, d) testing these hypotheses, and e) reaching conclusions (Brophy, 1990). Brophy (1990) continues by convincingly arguing that "Obviously, little or no higher-order thinking would be involved in a purely directive...approach to values education," (p.382). This leaves the reader to conclude that teacher pedagogy that is more interactive than simple teacher-directed instruction is more beneficial to high school students, as well.

Teachers should further strive to improve the three highest levels of listening: a) interpretation, b) evaluation, and c) response (Molina, Steurer, Twardy, & Young, 1997). This invariably entails a certain amount of teacher-led instruction, which can be used to provide a

basis upon which students might then be asked to critically expand and expound upon such knowledge. It is important that educators not mistake this higher-order pedagogy as being comprised of long, vague, abstract complex sentences. This sort of pedagogy can instead prove to be more difficult for students to understand (Molina et al., 1997).

While high school educators are intimately involved in fostering student thinking, such behavior can be stimulated without engaging in stifling or otherwise overbearing pedagogical practices. Indeed, it is important that teachers allow for unencumbered student participation in classrooms; consequently, it might be more desirable for teachers to provide minimal direction to students as opposed to being overly-directive (Greeno, 1997). All the while, teachers can remain focused on students' growth in classroom participation (Greeno, 1997). At the stage in students' educational careers where they are most primed to actively process the subject matter, it is incumbent upon high school teachers to fully cultivate these competencies by way of not only curricula, but the pedagogical techniques they employ at the front of the classroom.

### *2c: A Literature-Informed Grasp on Engagement Behaviors*

Classroom instructional quality will directly impact how students are positioned to engage and digest the subject matter. A richer appreciation of the desirable forms of critical and higher order thinking enables instructional leaders to revisit important instructional tenets that are proven to foster the most robust levels of student learning and achievement. These behaviors are not, however, stimulated automatically. Indeed, even the most effortful and purposive instruction can fall flat if such instructional strategies are not fully and appropriately directed at classroom learners.

Educators who appreciate what ideal learning behaviors look like must also possess the resolve to foster heightened levels of these pedagogical practices. Instructional leaders are better able to visualize the instructional refinements by placing these goals in the wider building-level context. The focus is, therefore, not simply on standalone engagement data, but how school leaders can tailor instructional efforts to accentuate the good and curtail the undesirable. While educational excellence remains the ultimate aim, considerations of standardized achievement growth naturally arise. Accordingly, student achievement growth becomes the final focus of the paper.

### *3a: The (Real Life) Impact of Student Learning*

The traditional focus of classroom instruction has changed little in public schools, even as the wider political and accountability environment is remarkably different than in years past. Cooper (1989) reports that 80-95% of classroom work is derived from published instructional material. While this represents a most expeditious way of preparing students for high-stakes testing, it may fail to enhance students' critical thinking and reasoning abilities. Indeed, it is not uncommon for instruction to involve teaching lower-order, basic skills so that students perform satisfactorily on standardized tests, such as the NAEP (Cooper, 1989).

Nickerson (1988) suggests that as teachers engage students in strategic thinking activities, this enables these students to become conscious of their own thinking and learning. This student ownership of his or her learning becomes an empowering feature of the student's educational experience, remaining with the student long after he or she leaves the classroom (Nickerson, 1988). Similarly, reflective thinking helps students consolidate and extend their knowledge base (Brophy, 1990). When students become active participants in their own assessments, for

instance, they develop a sense of responsibility that is required not only of capable students, but of capable citizens (Greeno, 1997).

While it is incumbent upon teachers to provide students with effective instruction, students' learning dispositions will influence the nature of such instruction. Tishman and Perkins (1993) note that being a good thinker requires certain dispositional characteristics. They further argue, however, that students can be taught such a disposition, which might enable them to think more critically. Tishman and Perkins (1993) enumerate the elements of the positive student learning dispositions that should be cultivated, which include: 1) encouraging students to be broad and adventurous, 2) promoting intellectual curiosity, 3) clarifying/seeking understanding, 4) being planful and strategic, 5) remaining intellectually careful, 6) seeking and evaluating reasons, and 7) being metacognitive (Tishman & Perkins, 1993).

A student who possesses a well-rounded knowledge base is ultimately able to marry this knowledge with more complicated and challenging inquiry (Greeno, 1997). While the possibility of knowledge-free learning instruction exists, the usefulness of mastery questions which call for knowledge and content has also been demonstrated to be effective (Cotton et. al, 1989). Instructional pedagogy that asks students to synthesize information by drawing upon current and prior knowledge to offer hypotheticals has also been shown to be effective (Cotton et al., 1989). Instructional leaders should also ensure that students are encouraged to introspectively reflect on the learning process itself (Nickerson, 1988). As students become acclimated to flexible thinking and learning, this will ultimately enhance their problem-solving skills (Underbakke, Borg& Peterson, 1993). The explicit instruction about the mechanics of

problem solving, it is important to note, allows for more transferability of such problem-solving skills (Underbakke, Borg & Peterson, 1993).

### *3b: Empirically Capturing Bottom Line Improvement Results*

It is important that today's teachers possess the knowledge of what desirable student engagement behaviors look like, and how to foster such classroom activity over time. This allows for a more searching inquiry of educational improvement efforts to be framed in the context of student engagement growth. To date, the reform literature has centered around more qualitatively conceptual terms of the vital importance of certain instructional and student engagement behaviors in advancing test score gains. But efforts to capture and manipulate both the desirable higher order thinking and problematic non-higher order thinking have been largely absent from the empirical research. Given even less attention is the potential standardized achievement impact that follows such alterations to student engagement.

A statistical approach that links desirable methods of instruction to standardized test performance represents only one side of the instructional improvement coin. Attention must also be paid to what lower order thinking looks like, and the impact that such classroom behaviors can have on student learning and achievement. Any resulting disparities in the proportion lower order engagement relative to the more desirable forms of classroom learning can then be discussed not simply in terms of bottom line test score growth, but also according to its differential impact by engagement type. Put into clearer perspective for practitioners, then, are end results that assume a practical and observable structure that can be monitored and altered

by high school instructional leaders over time. As a consequence, school leaders better understand not just the data, but how best to act upon it.

## **Methods**

### *The Instructional Practices Inventory*

The Instructional Practices Inventory (IPI) coding rubric is an instrument utilized by classroom observers to ascertain the nature of student engagement across classrooms within a 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, 2007). The IPI instrumentation allows a trained classroom observer to collect approximately 100-150 observational codes that capture student engagement behaviors for each school. The observation categories included in the IPI observation protocol are: (1) student disengagement, (2) student engagement in non-higher order activity without teacher participation, (3) student engagement in non-higher order activity with teacher support, (4) teacher-directed instruction, (5) student engagement in higher-order classroom discussion, and (6) all other higher-order student learning.

Table One offers an explanation of each of the six coding categories. It is important to note that the higher-order categories (“5” and “6”) represent desirable forms of student learning, whereas the lower-order categories (“1” and “2”) represent less effective and generally undesirable, indefensible forms of student activity within classrooms. It is not always possible, nor desirable, for students to be engaged solely in higher-order activities, however. As such, categories “3” and “4” account for those moments during classroom instructional time when the

teacher is primarily involved in informing and directing the students' activities in the classroom, as student engagement becomes mostly passive and inactive. This might come in the form of teachers informing students of certain tasks or logistical considerations or teacher-directed learning, both of which are inevitable components of effective teacher pedagogy and student learning.

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Insert Table 1 approx. here

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### *Statistical Model Configurations*

Hierarchical Linear Modeling (HLM) represents an especially attractive methodology upon which to address the theoretical concerns underlying the incorporation of the Instructional Practices Inventory (IPI) in school settings of all kinds. The structurally and spatially nested nature in which student learning and school processes are configured can be duly accounted for by HLM Modeling.

For the purposes of the present study, the engagement within classrooms among high schools that have incorporated the IPI process will be used as a starting point to accumulate the data needed to address the extent to which student engagement levels are altered as a result of IPI implementation, while also investigating the student engagement and standardized test performance relationship. To adequately account for the nesting of student engagement within high school classrooms in a greater environmental context, the introduction of a third level to the model that incorporates the region level (level three) can additionally be considered by the researcher as he attempts to account for the structure inherent in student learning.

Level-One School-wide engagement: Level-One of the HLM models employed in the study contained the variable that captured the student engagement levels within the high school classrooms. Raw percentage breakdowns are computed for each school type that provided three or more IPI classroom data profiles, in the form of singular disengagement codes for core and total classrooms (C1, T1 and C2, T2), higher order and an aggregated metric of distinctive higher order categories C5 and C6 (T56 and C56). As multiple classrooms observations are coded for each classroom with the building, over the course of a school day, a statistically representative depiction of student engagement levels within each school setting can be introduced into the multilevel statistical study at Level One of the HLM models. The assignment of student engagement levels as dependent variables in the model to test against the corresponding IPI practices and processes, as captured by coded IPI survey responses, has been emphasized at this level.

Other important building-level school inputs are also imbedded in this level of the HLM models. The proportion of teachers with master's degrees (Tchr\_mast), the proportion of students eligible for free and reduced lunch (FRL1), and the student teacher ratio (stu\_tchr) are accounted for at Level One. Each of these variables, to varying degrees, coincide with student engagement behaviors in dictating both the nature of student learning in the classroom and on standardized tests.

Level-Two School Districts: For the purposes of this study, traditional socioeconomic, and controllable and uncontrollable educational resources and input factors were collected and recorded for the corresponding school districts containing the schools that provided data for the

current research undertaking. More specifically, the per pupil expenditure levels (PPE), the percentage of minority students (Pct\_min), the free and reduced lunch rate at the district level (FRL), the percentage of families that have remained in the district the last five years (PCT\_not) and the proportion of married families (Now\_married) are included at Level Two. These variables, both in isolation and acting in concert, can govern student engagement and standardized achievement levels with considerable impact at times.

Level-Three Regional Professional Development Centers: Not unlike many states across the nation, Missouri is comprised of several disparate regions. Impoverished urban centers in Kansas City and St. Louis are surrounded by more affluent suburban districts, where stronger standardized test performance levels are reflective of these socioeconomic and demographic endowments. The several districts within the study were nicely dispersed across the region, creating averages that are statistically representative of regional demographic, controllable and uncontrollable inputs, and student achievement. The geography and economic makeup of these areas are disparate and enable meaningful across-region differences to be methodologically captured. Here, the FRL rates of regions were included in Level Three of each model.

A student engagement outcome of great interest for this study is the percentage of higher-order student engagement in core content area classrooms coded as a “5” or a “6” (AV\_C56). This metric was assigned as the dependent variable in both the two and three level models. As importantly, though, the non-higher order student engagement levels were also tested as dependent variables, to ascertain not only fluctuations that result from independent variable manipulations, but to compare any fluctuations to their higher-order counterparts. To test this theoretical proposition, the percentage of classrooms coded as either a “1”, “2”, (either student

disengagement (AV\_C1 or teacher inattentiveness, AV\_C2, within core classrooms) was assigned to be the dependent variable in HLM Model. Ultimately, the student engagement and achievement relationship within public high schools can be more thoroughly and holistically explored by testing data under a HLM statistical framework. Simply put, the HLM models enable the researcher to determine the extent to which the IPI more directly influenced student engagement levels, which might, in turn, also exhibit influence on standardized test score levels of schools.

#### *Explanation of Population Sample and Descriptive Data*

In 2005, numerous schools across Missouri and the nation began to conduct IPI classroom walkthroughs. These walkthroughs enable the level of student engagement in each classroom within a school to be captured and documented by a trained observer. At the time of this study, approximately 300 Missouri public school utilize the Instructional Practices Inventory with some degree of fidelity.

#### *Data Collection Procedure*

To collect IPI data, a certified data collector moves continuously from classroom to classroom throughout the school day, observing student engagement behaviors and coding that engagement on a data coding form. Two points are to be stressed at this point as it relates to the trained IPI classroom observers who conduct classroom walkthroughs: First, teacher and school leaders other than principals are designated as data collectors to diminish the possibility of bias in data collection or concern about the instrument as a mechanism for supervision or evaluation. Second, all IPI data collectors are to have an IPI reliability measure of .90 on a post-workshop assessment. In addition, inter-rater reliability is established during each IPI workshop, affirming that all trained data collectors from a given school (and across schools) provide reliable

classroom observation data. As such, the uniformity and standardization associated with the classroom coding procedure is not called into question. Generally, 120 to 170 data points are collected during a typical school day. These observations provide a comprehensive, empirical representation of the nature and level of student within the population sample of schools in the study. For the purposes of this study, the coded student engagement percentages associated with the IPI classroom observations were analyzed and incorporated as measurable independent variable metrics, introduced in the form of predictors in the HLM models.

### *Designing HLM Models to Address the Relationship Between Student Engagement and Achievement*

This study is principally concerned with testing whether a statistical relationship exists between the nature of student engagement across classrooms within school buildings and corresponding standardized achievement levels. In addition to two-level hierarchical models comprised of survey respondents (level one) and their respective districts (level two), a more complex three-level HLM model that includes the socioeconomic standing of regions was included in the study. By including the corresponding RPDCs at the third level of the hierarchical linear model, it can be determined whether the inclusion of the regional level represents a more realistic and holistic representation of the contextual variables and factors that might exhibit meaningful influences on student engagement patterns, as introduced into the statistical models.

### **Data Findings**

The descriptive statistics for the 79 high schools in the study are provided in Table Two below.

Insert Table 2 approx. here

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Table Three below provides the data from the 67 school districts that correspond to the schools included in the study.

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Insert Table 3 approx. here

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Finally, descriptive data from Missouri's nine Regional Professional Development Center's (RPDC's) are provided in Table Four.

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Insert Table 4 approx. here

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The two-level findings associated with the models tested in the study are provided in Table Five. Interesting disparities emerge between the slope magnitudes of higher and lower order thinking independent variables. Furthermore, differences in these independent variables appear when Communication Arts and Mathematics are designated as the dependent variables. More specifically, core classroom student disengagement ("C1") was found to be twice as impactful on Communication Arts proficiency levels (-.69 slope) than on Mathematics (-.38 slope). The only statistically significant findings associated with the higher-order thinking independent variables were found with respect to the Mathematics achievement models. Interestingly, the slopes of these higher-order thinking independent variables were considerably weaker (.21) than the slope magnitudes of their lower-order thinking independent variable counterparts.

The socioeconomic composition of the schools' student populations were also incorporated into the two-level models as independent variables. The magnitudes of the FRL rates of students at level one of the model ranged from -.20 - .23. When combined with the level two FRL magnitude values, the "aggregated effect" of FRL within these two-level models ranged from -.40 - -.41. Statistically significant findings were also evidenced for the student-teacher ratio, with slope values ranging from -.44 - -.48. Such a finding suggests that appreciable achievement gains would only begin to actualize after augmenting the size of school faculties to an extent that is financially untenable. Finally, the percentage of minority students within school populations also appear to detrimentally impact standardized achievement levels, as the slopes associated with this independent variable ranged from -.18 – -.36.

Also of note are the statistically insignificant findings associated with the percentage of teachers who possessed master's degrees, per pupil expenditures, the percentage of students' families that were not transient, and the percentage of students whose parents were married. While this is not to suggest these structural factors lack an important role in children's academic achievement, it does not appear that these variables are demonstrably impactful on MAP achievement levels.

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Insert Table 5 approx. here

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As revealed in Table Six below, the findings associated with the three-level model were almost identical to the two-level output. A few differences emerged, however: the per pupil expenditure (PPE) independent variable was found to be statistically significant but muted. Additionally, and in contrast to the two-level model, only the construct that measured higher-

order thinking in core classrooms was found to be statistically significant. The relationships of building-level inputs with achievement were clearly impactful in many instances. The specific outcomes effects, in terms of raw test score fluctuation magnitudes, are spelled out in the paper's final section.

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Insert Table 6 approx. here

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## **Discussion**

### *Statistical Snapshot*

Large spikes in higher-order student engagement are required to align high schools with the face of instructional excellence. The impact of high-order thinking on student achievement in high schools does not differ remarkably from what is found in elementary and middle schools. With the proportion of higher order thinking currently fixed at 20-30% across public high schools, the jump to 60% certainly represents an ambitious goal for instructional leaders in these buildings.

A highly desirable byproduct of this shift toward optimal improvement instruction are noteworthy test score gains. Higher-order student engagement does, however, appear to demonstrate less of an impact on standardized achievement levels than is the case for fluctuations in the levels of non-higher classroom activity. Nevertheless, higher-order achievement levels do impact standardized performance in a non-trivial manner. Higher-order student engagement levels that comprise 60% of all coded classroom behaviors in high schools yield superior standardized achievement rates relative to the average public school. That is, Mathematics proficiency rates are 8.52 points greater in schools that are home to optimal levels

of student engagement. As promisingly, mathematics proficiency rate enhancements of 8.88 points result were such engagement behaviors occur in core content area classrooms.

There exists no place in public schools for student or teacher disengagement in the high school classroom. Wiping these sorts of observed behaviors from the instructional slate is required in the name of appropriate instructional pedagogy. It is helpful, however, to frame the benefits not only in terms of the adherence to high professional standards, but also to the resulting outcomes benefits. Even though the proportion of these undesirable classroom behaviors is discovered to be quite low across public high schools, the complete eradication of such student and teacher disengagement leads to considerable test score gains.

The current student engagement levels within public high schools are such that an entire diminishment in their pre-existing levels would result test score growth that would provide a morale boost to the high school instructional reform mission. The complete eradication of student disengagement in core classrooms, for instance, would result in a 3.57 percent increase in Communication Arts proficiency rates. Similarly, with no recorded teacher disengagement in all classrooms “T2”, Communication Arts standardized achievement levels would increase by 3.6 percent. The combined result of the complete diminishment of current lower-order thinking levels, therefore, is a 7.26 percentage point increase in Communication Arts proficiency rates. As lower-order thinking student engagement levels were found to be less than 20%, were this number to be reduced to 0%, Mathematics proficiency rates would decline by 3.72 percentage points.

Of course, not all public high schools are found to exhibit identical levels of student and teacher disengagement across their classrooms. It is helpful to consider the impact of classroom disengagement levels in the context of differences between schools with average levels of this undesirable classroom behaviors (around 5% of coded observations) with those schools that confront more elevated levels of these sorts of observed student engagement activities (around 20% of coded observations).

The findings associated with the study provide a cautionary note for high school leaders. That is, the effects of lower-order student engagement levels on standardized achievement levels are great, but can become all the more debilitating to student achievement in very little time. To best appreciate the concept, again consider the comparison of the test scores differences in high schools with average levels of disengagement (5% of observed classroom behaviors) within buildings where these levels have been allowed to slide upward to 20% of all coded behaviors. Notable examples of performance discrepancies are highly illustrative of such dangers. Communication Arts standardized achievement levels are diminished by 13.68 points as a result of core classroom student disengagement levels that have crept upward to 20% of all coded student engagement activity. Communication Arts standardized achievement does not appear to be as impacted by non-higher order student activity with teacher disengagement across all classrooms (“T2”). When this coded observation is found to comprise 20% of student engagement behaviors, however, Communication Arts standardized achievement levels are 6.06 points lower in these high school settings than in schools that contain the average of 5% of such behaviors.

*Formulating an Actionable Practitioner Response*

This paper has unpacked a sweeping set of findings that spell out the extent to which student engagement behaviors across high school classrooms impact standardized achievement levels. Of course, some of these discoveries warrant greater and more immediate attention than others. While the impact of higher-order thinking on achievement is demonstrated, its influence is overshadowed by the extent to which student and teacher disengagement drive high school test scores downward.

Given the highly detrimental impact of lower-order thinking on student achievement, the focus on eradicating these classroom engagement behaviors must become the first order of business in any high school instructional improvement plan. Fortunately, lower-order student engagement is among the most conspicuous classroom conduct to detect and correct. High school instructional leaders who possess a fuller knowledge of its influence and importance in shaping the broader success of instructional reform efforts are at an advantage. They are then able to craft the sorts of goals that also cement a faculty-wide conscientiousness of the importance of pedagogy and resulting student engagement behaviors. The institutional reform mission is, therefore, bestowed with a gravity that would otherwise be absent from the agenda. In short, with a faculty-wide awareness that the composite nature of student engagement can cause test scores to steadily increase or precipitously plummet, it becomes easier for school leaders to identify and propose instructional improvement plans to purge high school classrooms of lower order thinking.

Prioritizing instructional improvement by targeting what matters the most is an important, though an incomplete, component of full-scale instructional improvement. It becomes as important for high school educators not to lose perspective of instructional excellence as a delicate balancing act of the twin goals of fully promoting higher order thinking while

extinguishing lower-order thinking from all classrooms. With the later objective first squared away, much work on the former will remain to be completed over several years of determined instructional improvement efforts. Although test score gains will not parallel the ballooning levels of higher order thinking, the combination of accentuating the desirable and eliminating those poor instructional practices will promote excellent high school instructional settings that yield the test score growth to show for it.

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