

**A Systems-based Synthesis of Research  
Related to Improving Students' Academic Performance**

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*This paper addresses the issue of school improvement by looking to research on both the variables that should be the focus of school improvement efforts as well as factors that make it more likely that the organization will actually implement research findings. Issues of transformational leadership, instructional leadership, and high functioning teams are addressed; Hattie's (2009) review of over 800 meta-analyses of variables related to school achievement is the primary source of identifying classroom and school variables that can be addressed by educators.*

As developed nations move out of the industrial age into the information/conceptual age, there is an ongoing debate about how to best prepare children and youth for adult success in the twenty-first century (Huitt, 1999b, 2007). While there is a consensus that schools should play a major role in this process, there is less agreement about exactly what that role should be. Some believe that the primary focus of schools should be academic preparation of students (Hirsch, 1987, 1996; Tienken, & Wilson, 2001), that classroom teachers are primarily responsible for student academic achievement (Darling-Hammond, 2000), and schools should efficiently and effectively organize themselves towards that task (Engelmann & Carnine, 1991). These efforts to improve schooling might be labeled *school reform* in that they accept that the desired outcome of schooling is academic achievement as measured by standardized tests of basic skills and that the focus of change should be on the practice of classroom teachers and school administrators.

Others believe a more holistic approach should prevail (e.g., Chickering & Reisser, 1993; Huitt, 2006) and that efforts of schools should be integrated with other social institutions such as family and community towards these more holistic ends (Benson, Galbraith, & Espeland, 1994). Efforts along these lines might be labeled *school revisioning* in that there is an advocacy that schools focus on a much wider range of desired outcomes (e.g., cognitive processing skills, emotional and social awareness and skills, moral character development). These approaches point to research reported by Gardner (1995) and Goleman (1995) stating that intellectual ability and academic achievement account for only about one-third of the variance related to adult success.

The focus of this paper is a review of research related to improving academic achievement in basic skills. A second paper will review research related to addressing a broader range of desired student outcomes.

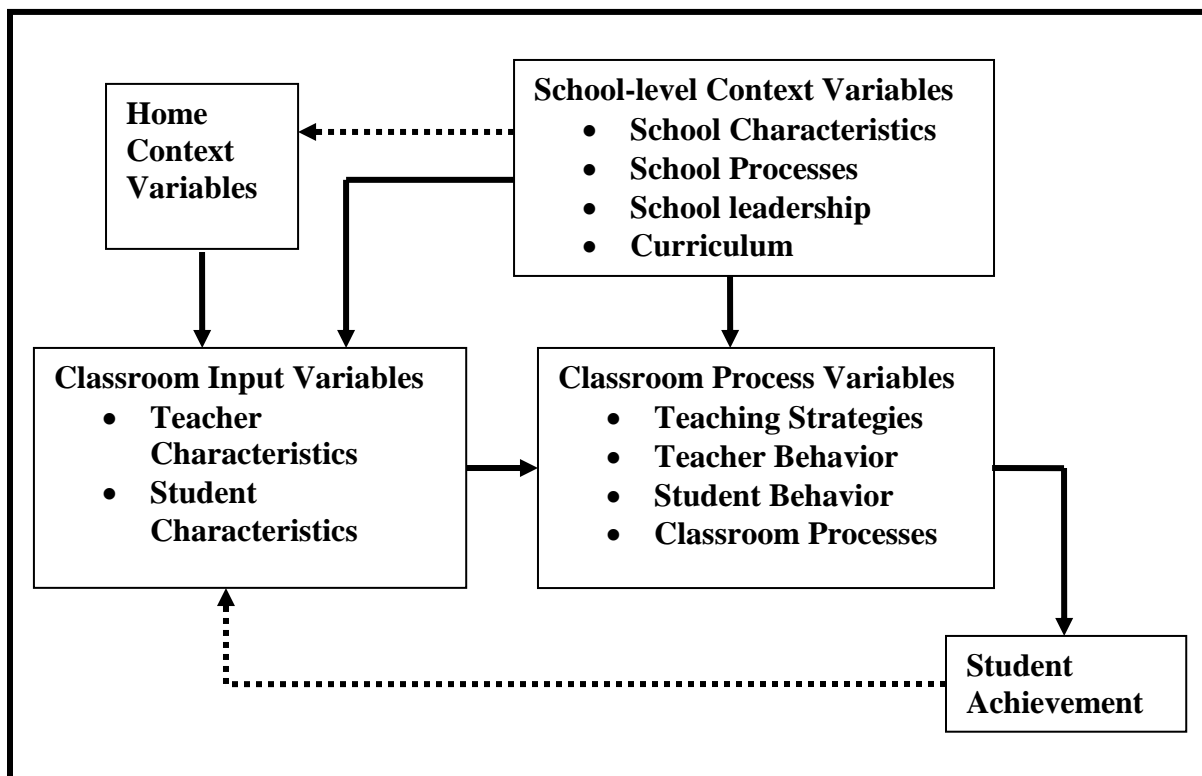
**Research-based School Improvement Efforts**

Over the past four decades researchers have identified a large number of variables that predict increases in student achievement (e. g., Carroll, 1963; Rosenshine & Stevens, 1986; Squires, Huitt, Segars, 1982; Walberg & Paik, 2000). Unfortunately, despite this extensive knowledge base about what works, there is still a great debate about how to improve schooling (Carpenter, 2000). One reason is that educational leaders seem to resist utilizing this research (Carnine, 2000; Covalieskie, 1994), although pressure from parents, legislatures, and business have given educators an increased incentive for doing so (Hess & Petrilli, 2006).

The large number of variables related to school learning is an important issue that must be considered when attempting to utilize research for schooling reform. For example, in a review of 800 meta-analyses, Hattie (2009) identified 138 variables significantly related to school achievement. This study followed earlier reviews of some 134 meta-analyses (Hattie, 1987; 1992) and summarized results from literally thousands of studies on many hundreds of variables.

A second important consideration is to understand classrooms, schools, families, and communities as systems (Green, 2000; Snyder, Acker-Hocevar, & Snyder, 2000). Attention must be paid to both developing well-functioning teams within schools (i. e., transformational leadership; Chin, 2007) while simultaneously addressing issues of improving the quality of teaching (i. e., instructional leadership; Teddlie & Springfield, 1993). Efforts at school reform that do not consider schools and classrooms as systems may find that the system merely adapts to the intrusion by outside forces in order to preserve the integrity of the teachers, classrooms, or schools that are the focus of change (Gustello & Liebovitch, 2009).

**Figure 1. Categories of Variables Impacting Student Academic Achievement**



### A Framework for Selecting Important Variables

One approach to reducing the number of variables to be considered as part of a school-reform effort is to select only those that meet a cut-off criterion for inclusion and organize those utilizing a framework for categorizing those variables. A standard method for establishing a cut-off criterion is *effect size*. The effect size essentially provides a standardized measure of the standard deviation between the correlation of two variables or between two treatments. This provides an estimate of the amount of change a variable might have on student achievement when that variable is manipulated. Hattie uses Cohen's (1988) method of calculation referred to as "d". In general, an effect size of 0.40 is considered a cut-off for selecting important variables and will be used in this project.

Huitt (2003) developed a framework that can assist in this process by identifying a small number of categories of variables and the relationships among them. Using a modified set of Huitt's categories and subcategories (see Figure 1) and selecting only variables that have an effect size of 0.40 or greater, the number of variables identified by Hattie can be reduced from 138 to 66. Variables related to each of the major categories and subcategories will be discussed separately. This framework presents a systems-based approach to considering factors related to school achievement by identifying home, school-level, and classroom-level variables and showing how they are interrelated.

#### Home Context Variables

Hattie (2009) identified three context variables related to the home environment that met the criteria of having an effect size greater than 0.40: (a) home environment;  $d = 0.57$ ; (b) socioeconomic status (SES);  $d = 0.57$ ; and (c) parental involvement;  $d = 0.51$  (see Table 1). Other research has shown that one of the most important factors related to both home environment and SES is the mother's level of education (School Reform News, 2003). This relationship has been confirmed in a wide variety of contexts, from major urban centers (Lara-Cinisomo et al., 2004) to rural Appalachia (Curenton & Justice, 2008).

**Table 1. Home Context Variables Related to Student Achievement\***

Rank	Domain	Revised	Influences	d.	pg #
31	Home	Home	Home environment	0.57	66
32	Home	Home	Socioeconomic Status	0.57	61
45	Home	Home	Parental involvement	0.51	68
		Home	Education of mother	N/A	

\* Source: Hattie, J. (2009). *Visible learning: A synthesis of over 800 meta-analyses relating to achievement*. London & New York: Rutledge.

While the home context factors are indirectly related to school learning, they are important control parameters. The percentage of students on free or reduced lunch is an excellent proxy variable for SES (Gill & Reynolds, 1999; Howley & Howley, 2004). When two schools have equal achievement, but one school has a greater percentage of students on free

lunch, then the educators at that school are providing a higher quality learning environment for students (Huitt, 1999a). This is one way to measure the value added to student achievement beyond that provided by the home environment or SES. At the same time, a school reform project at the pre-school, kindergarten, or elementary level that includes a component that addresses the mother-child relationship can have a long-term impact on a student's school performance (Mahoney et al., 1999).

### School-level Context Variables

Hattie (2009) identified twenty-one specific school-level context variables that met the 0.40 cut-off criteria (see Table 2). One variable identified is a school characteristic, five relate to school-level processes, and fourteen relate to school-wide implementation of specific curriculum.

**Table 2. School-level Context Variables Related to Student Achievement \***

Rank	Domain	Revised	Influences	d.	pg #
59	School	Schl Char	School size	0.43	79
3	Teaching	Schl Proc	Providing formative evaluation of teaching	0.90	181
52	School	Schl Proc	Acceleration	0.88	100
55	School	Schl Proc	Classroom behavioral	0.80	
5	Teaching	Schl Proc	Comp interventions for lrng disabled stdts	0.77	217
68	Student	Schl Proc	Early intervention	0.47	58
74	Student	Schl Proc	Preschool programs	0.45	59
50	School	Schl Struc	School effects	0.48	
15	Curricula	Curricula	Vocabulary programs	0.67	131
16	Curricula	Curricula	Repeated reading programs	0.67	135
17	Curricula	Curricula	Creativity programs	0.65	155
22	Curricula	Curricula	Phonics instruction	0.60	132
27	Curricula	Curricula	Tactile stimulation programs	0.58	153
28	Curricula	Curricula	Comprehension programs	0.58	136
35	Curricula	Curricula	Visual-perceptual programs	0.55	130
43	Curricula	Curricula	Outdoor/adventure programs	0.52	156
46	Curricula	Curricula	Play programs	0.50	154
47	Curricula	Curricula	Second/third chance programs (Rdg Recovry)	0.50	139
54	Curricula	Curricula	Mathematics	0.45	144
57	Curricula	Curricula	Writing Programs	0.44	141
64	Curricula	Curricula	Science	0.40	147
65	Curricula	Curricula	Social skills programs	0.40	149

\* Source: Hattie, J. (2009). *Visible learning: A synthesis of over 800 meta-analyses relating to achievement*. London & New York: Rutledge.

**School characteristics.** An important school-level variable that met the cut-off criteria is school size ( $d = 0.43$ ). While Hattie, in general, does not consider interaction effects, optimal school size appears to be higher for affluent, majority, non-rural students, and lower for poorer, minority, and rural students (Howley, 1996; Howley & Howley, 2004). This is a variable under the control of the school board and is another important control parameter for the functioning of schools and classrooms.

**School processes.** Hattie (2009) found several school process variables related to school achievement. One of the most important is that the school provides formative evaluation data to teachers to assist them in making decisions about the effectiveness of their classroom practice ( $d = 0.90$ ). Later in this paper, collecting data on the student intermediate outcome variable Academic Learning Time (ALT) will be discussed as a method to put this research into practice. Two other important school process variables include implementing a common classroom management program based on behavioral principles ( $d = 0.80$ ) and developing a comprehensive intervention program for learning disabled students ( $d = 0.77$ ). Having a program that accelerates students through the standard school curriculum also is beneficial ( $d = 0.88$ ). Finally, for elementary schools, having a preschool program ( $d = 0.45$ ) and engaging in early intervention ( $d = 0.47$ ) can also be beneficial. Overall, Hattie reported that school-level variables made an important contribution to student achievement ( $d = 0.48$ ).

**School leadership.** Although the contribution of school principals and leaders did not meet Hattie's (2009) cut-off criteria ( $d = 0.36$ ), when he differentiated between the effects of instructional leadership (e.g., establishing high expectations for student achievement, translating general expectations into specific learning objectives, creating safe environments) and transformational leadership (e.g., inspiring educators and students to put more energy into teaching and learning, providing participants with a rationale for the moral value of their work, working collaboratively as team members), he found instructional leadership had a stronger impact on student achievement than did transformational leadership. The message in this research seems clear: while transformational leadership may work to create a better teaching and learning environment, unless effort is made to generate specific goals, objectives, and lessons, there is a small probability of having an impact on student achievement.

**Developing faculty teams.** Losada and his colleagues (e.g., Fredrickson, & Losada, 2005; Losada, 2008a; 2008b; forthcoming; Losada, & Heaphy, 2004) provide data on team functioning not available to Hattie (2009) in his meta-analysis. This research is especially important in a systems approach to school improvement as it provides the processes by which additional school leadership can be developed through a process known as site-based management (Leithwood, & Menzies, 1998; Ortiz & Ogawa, 2000).

Losada (2008a & b) reported on a small number of factors that distinguish flourishing teams from those that languish or function poorly. He defines *flourishing* teams as those that are effective in their performance, functioning with integrity, and where team members are emotionally satisfied with each other and the organization. Losada's *meta learning model* can account for as much as 92% of the variance related to the functioning of teams.

The first factor in the meta learning model is a control parameter, *connectivity*, which Losada (1999) defined as the degree to which the individuals are related/connected to the group, as measured by the interactions among group participants. Two other parameters are also identified: *viscosity* (environmental resistance to change), and *negativity* (how quickly one responds to negativity to avoid harm). These three control parameters establish the environment

within which teams function. Novick, Kress, and Elias (2002) report that working to modify these parameters can impact school performance.

The variables most directly related to team functioning are three ratios of relatively easily measured variable pairs (Losada, 2008a & b). The first is a ratio of *inquiry* to *advocacy* (I/A) or the ratio of the number of questions asked to the amount of talking done by group members. The second is a ratio of *positivity* to *negativity* (P/N) or the ratio of positive to negative statements made by group participants. The third variable is a ratio of *other* to *self* (O/S) or the ratio of the extent to which members' statements are focused on others or themselves.

**Curriculum implementation.** A final school process factor is the curriculum implemented at the school. Hattie (2009) identified 14 programs that met his cut-off criteria. Obviously, a school would not be able to implement all 14 and some specific selections would have to be made, depending upon the level of the school as well as achievement and demographic characteristics of students. Among the most powerful influences were vocabulary programs ( $d = 0.67$ ), repeated reading programs ( $d = 0.67$ ), creativity programs ( $d = 0.65$ ), and phonics instruction ( $d = 0.60$ ). Also included in this list were mathematics programs ( $d = 0.45$ ), science programs ( $d = 0.40$ ), and social skills development programs ( $d = 0.40$ ).

### Teacher and Student Input Characteristics

A third category of contributing factors related to school achievement identified in Figure 1 includes the characteristics of teachers and students before they enter the classroom (see Table 3). Hattie (2009) identified three variables related to teacher characteristics that met his cut-off criteria. The first, of most interest to teacher training programs, is the effect of micro teaching (the provision of direct, explicit development of skills such as questioning techniques) during preservice training ( $d = 0.88$ ). The second, of more interest to schools, is the effect of professional development of faculty on school achievement ( $d = 0.62$ ). Finally, teacher expectations (more recently called teacher efficacy; Goddard, Hoy, & Woolfolk-Hoy, 2000) was important ( $d = 0.43$ ). Additionally, Goddard et al. (2000) found teacher efficacy to be especially important when aggregated across teachers in a single school, providing an estimate of a school-level variable related to expectations for student achievement.

The impact of traditional teacher training and the impact of teacher subject matter knowledge is the focus of much debate recently (Cross & Rigden, 2002; Darling-Hammond, Holtzman, Gatlin, & Heilig, 2005), but were not found to be significant factors ( $d = 0.11$  and  $d = 0.09$ , respectively). Overall, Hattie (2009) found that teacher characteristic effects ( $d = 0.32$ ) were not as important as school effects ( $d = 0.48$ ).

Hattie (2009) found 9 student characteristic variables that met his cut-off criteria. The first two, students' self-report of their previous grades (a correlate of student self-efficacy) and students' Piagetian stage of cognitive development, were more highly correlated with student achievement than any other of the 138 variables ( $d = 1.44$ ,  $d = 1.28$ , respectively). Prior achievement was also an important factor ( $d = 0.67$ ).

Hattie (2009) also reported that the setting of goals, especially ones that meet high standards, is an important input variable for both teachers and students ( $d = 0.56$ ). This supports previously reported research that, while there are a number of different types of goals related to achievement, they can be one of the most important factors in increasing students' motivation to learn (Covington, 2000; Dweck, 2006; Elliott, 2007). Additionally, the goal-related variable of student's motivation was found by Hattie to be important ( $d = 0.48$ ).

**Table 3. Classroom Input Variables Related to Student Achievement \***

Rank	Domain	Revised	Influences	d.	pg #
4	Teacher	Tchr Char	Micro teaching	0.88	112
19	Teacher	Tchr Char	Professional development	0.62	119
58	Teacher	Tchr Char	Expectations (teacher efficacy)	0.43	121
85	Teacher	Tchr Char	Teacher effects	0.32	
1	Student	Std Char	Self-report grades (self-efficacy)	1.44	43
2	Student	Std Char	Piagetian programs (stage of cognitive dev)	1.28	43
		Std Char	Student's prior cognitive ability (IQ)	1.04	**
14	Student	Std Char	Prior achievement	0.67	41
38	Student	Std Char	Pre-term birth weight	0.54	51
49	Student	Std Char	Concentration/persistence/engagement	0.48	49
51	Student	Std Char	Motivation	0.48	47
60	Student	Std Char	Self-concept	0.43	46
66	Student	Std Char	Reducing anxiety	0.40	49
34	Teaching	Cls Input	Goals	0.56	163

\* Source: Hattie, J. (2009). *Visible learning: A synthesis of over 800 meta-analyses relating to achievement*. London & New York: Rutledge.

\*\* [http://www.teacherstoolbox.co.uk/T\\_effect\\_sizes.html](http://www.teacherstoolbox.co.uk/T_effect_sizes.html)

### Classroom Process Variables

The most direct influence on student achievement is what actually goes on in classrooms, shown in Figure 1 as classroom process variables. There are three subcategories: (a) teacher behavior, (b) student behavior, and (c) miscellaneous factors such as classroom climate (see Table 4).

**Teacher behavior.** A number of researchers have demonstrated that effective teachers are an important component of any effective school's practice (e. g., Darling-Hammond, 2000). Hattie (2009) grouped 59 of the 183 variables he identified in two categories labeled *teacher* and *teaching*. However, we chose to use the term *teacher* to identify teacher characteristics as discussed above. We use the term *teaching* to identify teacher classroom behaviors and have moved some of the variables he placed in his teaching category to other categories. For example, he labeled comprehensive teaching reforms as a teaching variable; however, we believe it is more correctly a school process variable as it is under the direction of school-level administrators.

Two types of teacher classroom variables were identified. The first, termed *teaching strategies*, relate to different approaches to classroom instruction. The second, termed *teaching events*, is focused on identifying specific, observable class activities that can be measured independently.

There were 14 teaching strategies that met Hattie's (2009) cut-off criteria. The two with the largest effect sizes were engaging in reciprocal teaching ( $d = 0.74$ ) and utilizing meta-

cognitive strategies ( $d = 0.69$ ). A related strategy, teaching the steps in problem solving, was also highly significant ( $d = 0.61$ ). Overall, teaching strategies were deemed quite important ( $d = 0.60$ ).

**Table 4. Classroom Process Variables Related to Student Achievement \***

Rank	Domain	Revised	Influences	d.	pg #
9	Teaching	Tchg Strat	Reciprocal teaching	0.74	203
13	Teaching	Tchg Strat	Meta-cognitive strategies	0.69	188
20	Teaching	Tchg Strat	Problem-solving teaching	0.61	210
25	Teaching	Tchg Strat	Study skills instruction	0.59	189
24	Teaching	Tchg Strat	Cooperative vs. individualistic learning	0.59	213
26	Teaching	Tchg Strat	Direct Instruction	0.59	204
29	Teaching	Tchg Strat	Mastery learning	0.58	170
33	Teaching	Tchg Strat	Concept mapping	0.57	168
37	Teaching	Tchg Strat	Cooperative vs. competitive learning	0.54	213
40	Teaching	Tchg Strat	Keller's PIS	0.53	171
44	Teaching	Tchg Strat	Interactive video methods	0.52	228
48	School	Tchg Strat	Small group learning	0.49	94
63	Teaching	Tchg Strat	Cooperative learning	0.41	212
62	Teaching	Tchg Strat	Matching style of learning	0.41	195
23	Teaching	Tchg Strat	Teaching strategies	0.60	200
8	Teacher	Tchg Events	Teacher clarity	0.75	125
10	Teaching	Tchg Events	Feedback	0.73	173
12	Teaching	Tchg Events	Spaced vs. mass practice	0.71	185
21	Teacher	Tchg Events	Not labeling students	0.61	124
30	Teaching	Tchg Events	Worked examples	0.57	172
42	School	Tchg Events	Classroom management	0.52	102
53	Teaching	Tchg Events	Questioning	0.46	182
61	Teaching	Tchg Events	Behavioral objectives/Advance organizers	0.41	167
56	Teacher	Tchr Beh	Quality of Teaching	0.44	115
18	Teaching	Std Beh	Self-verbalization/self-questioning	0.64	192
70	Teaching	Std Beh	Time on Task	0.38	184
		Std Beh	Content Overlap	N/A	
		Std Beh	Daily Success	N/A	
		Std Beh	Academic Learning Time	N/A	
11	Teacher	Cls Proc	Teacher - student relationships	0.72	118
36	Teaching	Cls Proc	Peer tutoring	0.55	186
39	School	Cls Proc	Classroom cohesion	0.53	103
41	School	Cls Proc	Peer influences	0.53	104

\* Source: Hattie, J. (2009). *Visible learning: A synthesis of over 800 meta-analyses relating to achievement*. London & New York: Rutledge.



Eight variables were classified as teaching events. The most important were teacher clarity ( $d = 0.75$ ), providing corrective feedback ( $d = 0.73$ ), and having students engaged in distributed rather than mass practice ( $d = 0.71$ ). These were some of the strongest factors identified by Hattie (2009), ranking number 8, 10, and 12, respectively. Overall, the quality of teacher behavior was found by Hattie to be an important factor ( $d = 0.44$ ).

**Student behavior/intermediate student outcomes.** The subcategory of student behavior was not utilized by Hattie (2009). However, given the importance of providing teachers with feedback on classroom practices, it is deemed central to putting research into practice. Carroll (1963) identified the student behavior *perseverance* as an important component of time needed to learn (Hattie identified concentration, persistence, and engagement as important student characteristics;  $d = 0.48$ ). Stallings and Kaskowitz (1974) combined student perseverance with the teacher behavior *opportunity* and labeled this variable student engaged time or time-on-task. Hattie (2009) reported that time-on-task (which he labeled a teaching variable) did not meet his cut-off criteria ( $d = 0.38$ ). Additionally, previous critiques of the importance of time-on-task point out that it is a measure of the quantity, not the quality, of time students spend in classroom learning (Squires et al., 1982). Variables that measured the quality of student classroom time were not included in the meta-analyses that Hattie reviewed.

Two variables that address the quality of time spent by students in the classroom are content overlap and student success on academic tasks. Brady, Clinton, Sweeney, Peterson, & Poynor (1977) identified content overlap as an important measure of a student's opportunity to learn and defined it as the extent to which the content objectives measured on the criterion achievement test were actually taught. The issue of aligning content covered by students in the classroom and content that is assessed by standardized tests can explain up to two-thirds of variance among standardized test scores (Wishnick, as cited in Cohen, 1995). Unfortunately, the amount of instructional time devoted to covering tested content is often difficult to obtain; several studies have shown that, on average, textbooks used in classrooms cover only 40% to 60% of the content addressed by standardized tests (Brady et al., 1977; Cooley & Leinhart, 1980). Finally, Fisher et al. (1978) showed that the variable *success*, defined as the how accurately students completed assigned classroom work, was an important predictor of student achievement.

An appropriate time measure that addresses both quantity and quality concerns is Academic Learning Time (ALT) defined as "the amount of time students are successfully engaged in content that will be tested" (Squires et al., 1982, p. 14-15). ALT combines the three student behavior variables previously discussed: time-on-task, content overlap, and success. Most importantly, ALT can serve as "a proximal measure of student learning-as-it-occurs" (Fisher et al., 1979, p. 35). These researchers found that the average residual variance accounted for by the combined ALT variables was significant (Grade 2 reading = 0.07; Grade 2 mathematics = 0.04; Grade 5 reading = 0.03; Grade 5 mathematics = 0.09, p. 4-32).

Berliner (1978, 1990) showed that ALT could be successfully addressed in classrooms by separately observing the different components and then combining them to produce a variable that could be used to judge the effectiveness of teachers' classroom practice. Huitt (2003) argued that the three components of ALT (content overlap, time-on-task, and success) are important intermediate measures of student achievement and could be viewed as the *vital signs* of classroom processes. Systematic measurement of these three components can provide teachers the formative evaluation feedback that was discussed earlier as an important school process variable and a critical aspect of utilizing research.

**Miscellaneous classroom variables.** There are a number of miscellaneous variables that were classified as classroom processes including the strength of teacher-student relationships ( $d = 0.72$ ), the use of peer tutoring ( $d = 0.55$ ), the amount of classroom cohesion ( $d = 0.53$ ), and peer influences ( $d = 0.53$ ).

### Summary and Conclusions

This paper reviewed research-based factors impacting student achievement using a systems approach. A fundamental concept is that a different paradigm is needed when considering how to use research in school reform efforts. In a linear system, utilizing the classical mechanical paradigm developed by Newton, the amount of change in the outcome variable (e.g., school achievement) is directly proportional to the change in a context, input, or classroom process variable (e.g. school size, teacher efficacy, quality of instruction, student time-on-task). There is an assumption in much of the school improvement research that if one can identify and maximize the single most important variable related to school achievement, school learning as measured by standardized achievement tests will increase. However, in a complex dynamical system such as a classroom or school, where variables are related interdependently and non-linearly, the amount of change in a single classroom or school variable can be disproportional to the change in student learning (Guastello & Liebovitch, 2009). It may be that a great deal of energy is expended on increasing one factor of the school, but the overall functioning of the school increases only slightly. On the other hand, small, but important, changes in a number of related factors can result in a large change in school functioning and performance. Losada's (2008a & b; forthcoming) research suggests that the movement from *poor functioning* to *languishing* to *flourishing* teams is a difficult-to-recognize, non-linear process. The same issue applies to the functioning of schools (Wheatley, 1999).

This is a fundamental principle in a systems-based approach; it is expected that multiple modifications at the school and classroom levels will be made simultaneously. There is no need, in fact it would be unwise, to make only one modification and determine its impact before implementing another. For example, curricula decisions as well as school-wide implementation of classroom management practices and teacher strategies could be designed and implemented by the principal and school-based teams, leading to a school utilizing the best of the site-based management literature. Simultaneously, the school might also work with parents to impact the home environment, subsequently impacting the characteristics for students entering later grades. The resulting increase in student achievement will also impact student characteristics, creating an ever-increasing spiral of positive effects.

Senge (1990) advocated that schools should become learning organizations. He stated that a well-functioning learning organization provides an environment, "where people continually expand their capacity to create the results they truly desire, where new and expansive patterns of thinking are nurtured, where collective aspiration is set free, and where people are continually learning to see the whole together" (p. 3). Providing educators with formative evaluation data seems imperative to developing a learning organization as envisioned by Senge (1990). As shown in Figure 1, the most direct impact on student achievement is what students and teachers do in classrooms. Although there are a wide variety of variables that could be the focus of a school improvement project, we believe that the research showing the significance of providing formative evaluation data to teachers of effectiveness of their classroom practice points to the importance of collecting data on intermediate student outcomes as a core element of

putting research into practice. Therefore, we recommend that the collection of baseline data for the three components of ALT (time-on-task, content overlap, and success) provide an initial focus for school reform efforts. These intermediate student outcome variables will provide the principal and teachers with an understanding of student classroom behavior at every stage of a school reform process. As school- and classroom-level variables are selected, initial baseline data should be collected on those variables also.

At the same time, systematically collecting data on selected school reform practices is necessary to determine if decisions have actually been implemented. It is this multi-phase process of collecting baseline data, making and implementing decisions regarding change practices, collecting data on implementation, and then determining if intermediate outcomes are moving in the desired direction that provides the foundation for establishing a learning community. It is critical that both the selection of important factors identified by research and the processes by which those are implemented and evaluated be addressed in school reform projects.

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